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TOWN OF KIRKLAND LAKE WATER TREATMENT PLANT ALTERNATIVE PROCESS RESEARCH

R. A. C. PROJECT NO. 289
FINAL REPORT

Prepared for Environment Ontario by:

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APRIL 1990

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SUMMARY

This study, funded by the Ontario Ministry of the Environment with the assistance of the Town of Kirkland Lake, was designed to assess the best water treatment process and treatment chemicals for the water supply, namely Gull Lake, to the Town of Kirkland Lake and adjacent communities.

Several studies have been carried out on this water in the last twenty years. In 1963 work by C.F. Schenk of the Ontario Water Resources Commission investigated the problem of a fish-like taste and odour in Gull Lake water and concluded that it was due to algae formation.

There are colour and turbidity increases during spring and fall, although the most severe problems are due to the algae. The combination of a shallow lake which warms quickly and contains elevated levels of phosphorus and nitrogen gives optimum conditions for algae growth.

At present the treatment of Gull Lake water is, exclusively, chlorination and fluoridation which has little effect on any of the problems experienced with this water.

A study carried out by Proctor & Redfern in 1985 on direct filtration concluded that it was difficult to obtain filter runs of more than 10 hours without termination of the run, due to turbidity breakthrough or headloss.

After these studies proved unsuccessful it was decided to assess three alternative technologies for treatment of the Kirkland Lake water. Firstly, a plate flocculator/plate separator technique followed by a dual media filter was evaluated. This method is used with considerable success on waters in Europe and had not previously been utilized for drinking water treatment in Ontario. The second technology employed a high rate upflow clarifier followed by a multi media downflow filter which has limited use in Ontario and has not been directly compared to more conventional forms of water treatment. The final technology was a standard method using mechanical flocculation and a plate separator followed by dual media filtration.

These pilot plant tests were carried out between January and March, a period during which the Kirkland Lake community has its highest water usage. It is also the time of the coldest water temperature. All three technologies were required to treat water from Gull Lake ranging in temperature from 0 to 2°C, a range well below that required for optimum coagulation by many chemicals.

Various coagulants and coagulant aids (organic and inorganic) were assessed on each of the process systems in order to optimize the chemicals and dosages required.

The following system parameters were monitored throughout the pilot testing program:

- turbidity (raw, pre-filtration, filtered)
- colour (raw, pre-filtration, filtered)
- alkalinity
- hardness
- pH
- aluminum residual
- headloss
- length of filter run

By using the results of these parameters and others it was possible to assess the relative efficiency of each water treatment system and to compare one system with the other two.

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1.0 INTRODUCTION

1.1 General

The water drawn from Gull Lake to serve the communities of Kirkland Lake, Swastika and Chaput Hughes has undergone several investigations in the past twenty years. These studies have mainly been concerned with the taste and odour problems which occur periodically. At the present, except for chlorination and fluoridation, no method of treatment of the water is implemented at the Kirkland Lake pumping station. Proctor & Redfern has been involved with two investigations on the possibility of using various types of water treatment and filtration on this water. The first study "Town of Kirkland Lake Water Filtration Plant Pre-Design Report" dated October 1985 investigated the use of "direct filtration" as a means of treatment and concluded that "full" treatment was required. The second study looked at three different water treatment systems which are capable of treating this water. These were investigated in detail and are covered in this report.

1.2 Background

Gull lake is fairly typical of a northern Ontario fresh lake water with water characteristics such as low alkalinity, low hardness and a colour of 15 - 35 TCU although it should be mentioned that its alkalinity and hardness is higher than some lakes in the region. The current treatment of this water is chlorination and fluoridation, which is limited in its capacity to deal with the colour problem and the variations in the water quality that occur during spring and fall, or as a result of climatic deviations. The objective of this study was to determine:

(a) the best and most economical treatment process.
(b) the optimum chemical combinations and dosages.

The study was carried out during the period of January to March 1987; this period constitutes the time span of highest water demand in the

Kirkland Lake area. At this time of year incoming water is generally in the 0 - 2°C range which is not conducive to optimum alum coagulation. This low temperature, in addition with lower than optimum alkalinity and hardness, makes both the chemical coagulation and floc separation methods less effective.

Water is drawn by the Gull Lake Pumping Station from a shallow forebay which is approximately 1.6m deep but varies in depth significantly, depending upon water levels in the Lake. This source has caused several problems at different times of the year. The levels of colour, turbidity and dissolved organic carbon in the raw water are higher than currently recommended by the Ministry of the Environment guidelines as detailed in the "Ontario Drinking Water Objectives" handbook.

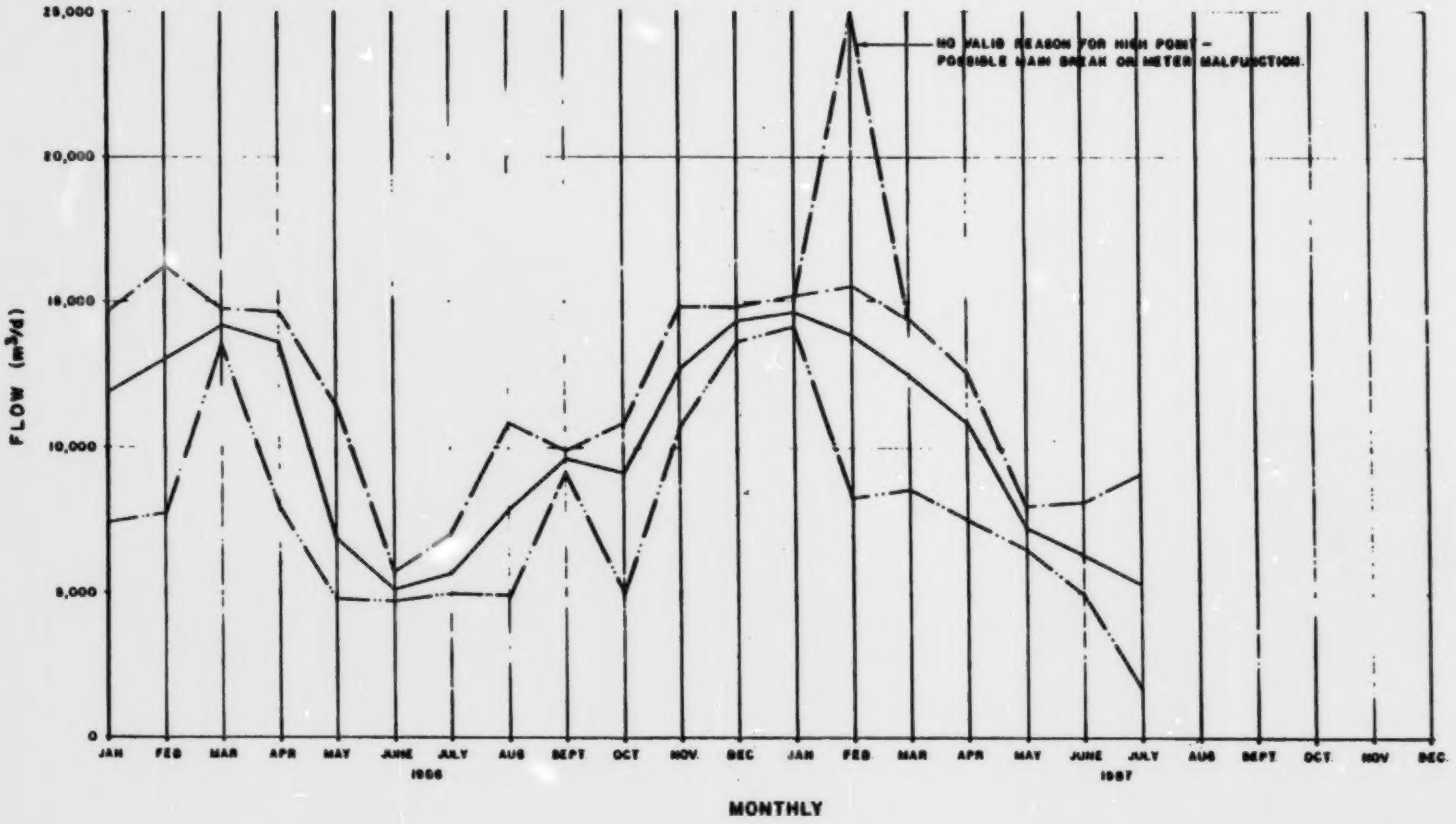
At certain times of the year odour and taste problems arise. The Ontario Water Resources Commission report by C.F. Schenk on 19th November 1963 examined the periodic problems experienced by consumers of Gull Lake water. This report revealed that "a fishy or cucumber-like" taste and odour is known to occur during the summer months for a period of three to four weeks and although its source has never been fully investigated it is thought to be due to algae. There are times when this problem occurs during the winter and its effects are almost intolerable; this occurs once in every four or five winters and usually during a cold autumn when ice forms on the lake prior to snow. Superchlorination of this water has been attempted in order to reduce the unpleasant taste but the pumping station is not capable of carrying this out with any degree of precision and complaints of chlorine taste and odour in the water are often received.

Both colour and turbidity increase during the spring and fall as both the climate and the biological activity changes. It is generally believed that most of the severe problems that occur are due to algae and chemical analysis has revealed Gull Lake to be a potentially productive source of algae. The water is moderately hard with sufficient phosphorus, nitrogen (as free ammonia) and iron to promote seasonal upsurges in planktonic algae. The fact that the lake is relatively shallow also enhances the algae productivity of the lake since the shallow water warms quickly and sunlight penetrates the entire body of water - these are optimum conditions for algae growth. Furthermore the very shallow forebay produces an abundant growth of vegetation which decomposes during the winter months. This, in conjunction with algae present, may produce a synergistic relationship which can also enhance the taste and odour problems.

During the period of the pilot testing a significant number of copepods were observed in the forebay whereas few were found further out in the lake, where the proposed new intake will be located at a depth of 5 to 6 metres.

1.3 Plant Operating Conditions

The water demand from Gull Lake by the surrounding communities follows a cyclical pattern of water demand, as shown in Figure 1. As in many northern communities, the highest demand is during the winter months when taps are left running in order to prevent frozen pipes. This is also the most difficult time to treat water due to its low temperature. However, the colour is also lower in the winter months. The average monthly volumes, shown in Figure 1, consist of three "high winter months" and four "low summer months". Problems in colour and turbidity are often encountered during the spring and fall with the taste and odour problem arising at various times of the year.



TOWN OF KIRKLAND LAKE

ALTERNATIVE PLANT RESEARCH
PRE - DESIGN REPORT

SYSTEM DEMANDS

Proctor & Redfern Group
Consulting Engineers and Planners
Toronto

E.O. 86156

FIGURE No. 1

2.0 PILOT PLANT STUDIES

2.1 Raw Water Quality

Analyses of the raw water in Gull Lake have been made by the Ministry of the Environment over many years. This water is fairly typical of many northern waters, except that calcium hardness and alkalinity are both higher than some of these waters. The main parameters of concern in the raw water are:

o	Hardness	40 - 50 mg/L
o	Alkalinity	35 - 40 mg/L
o	pH	6.8 - 7.5
o	Colour	15 - 35 TCU
o	Turbidity	1 - 2 FTU
o	Dissolved organic carbon	6.0 - 6.5 mg/L

In addition the biological activity of the water was also of concern since it causes the periodic taste and odour problems.

Although previous reports found Gull Lake to contain phosphorus, nitrogen (as free ammonia) and iron, we found in January and March that phosphorus was below 0.010 mg/L, nitrogen below detection limits and iron at 0.016 mg/L. However, plant records show that the iron level, in particular, is variable depending upon the seasons.

At the time of Proctor & Redfern's study no taste or odour problems were present.

2.2 Direct Filtration Pilot Work (Pre-Design Report -1985)

2.2.1 Method and Objective

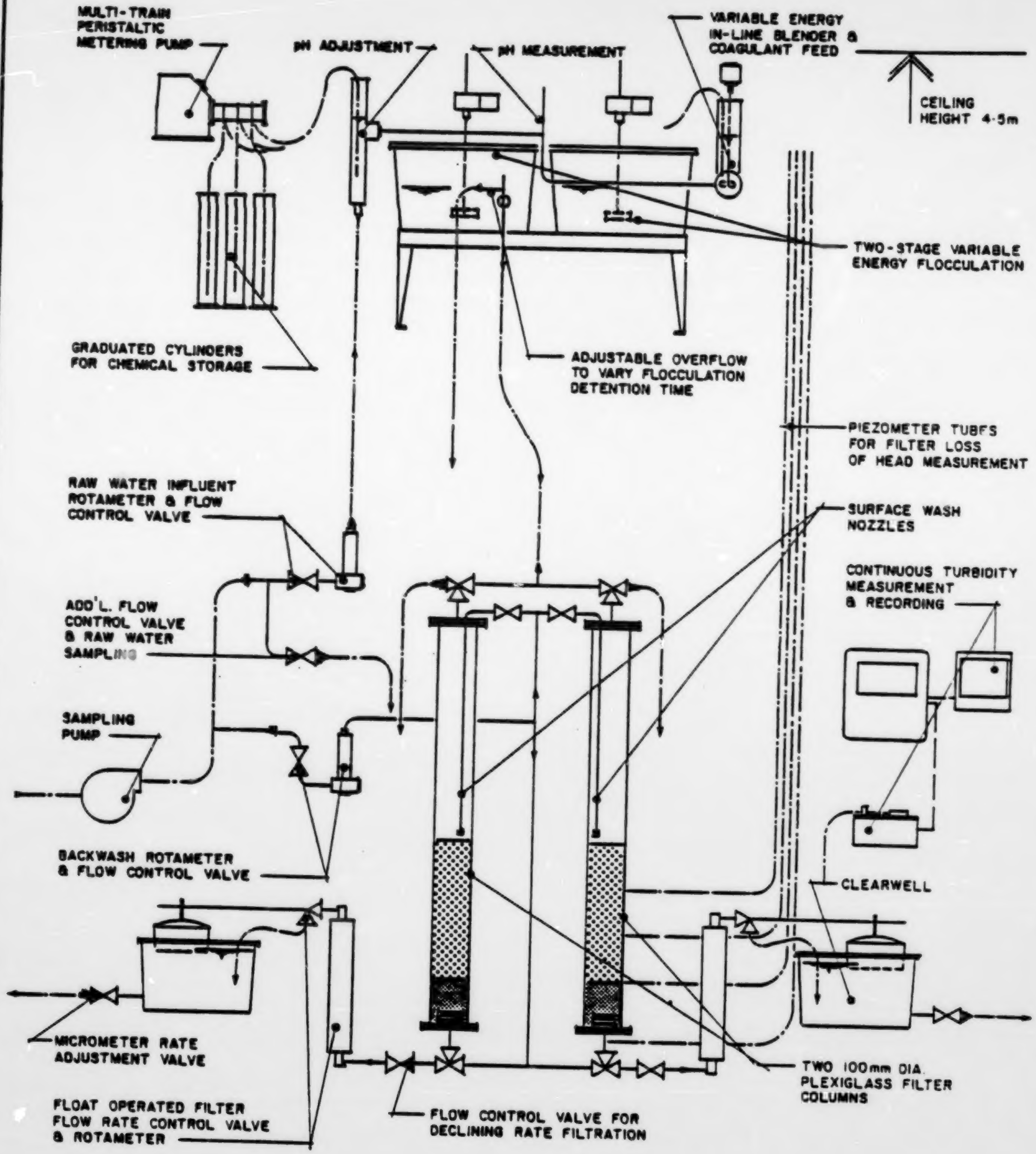
The direct filtration pilot work was performed in 1985 and is reported in the Proctor & Redfern "Town of Kirkland Lake - Water Filtration Plant Pre-Design Report" of October 1985. This work was carried out as a result of a proposal to the Ministry of the Environment to examine this technique of water purification. The pilot plant used is shown in Figure 2.

To summarize, the objectives of the direct filtration study were to evaluate filter performance in terms of colour removal, particulate removal and filter run duration, with varying chemical dosage rates. Other potential variables were kept constant:

- Filter rate: 12 m/hr. in one column and at 18 m/hr. in the second.
- Filter media - similar in both columns, 200 mm bottom layer of 0.5 mm effective size sand and 500 mm upper layer of 1.1 mm effective size anthracite.
- In-line coagulation - constant energy and flow rate.
- Series or tapered flocculation - constant energy and detention.
- Primary coagulant and coagulant aids - aluminum sulphate (alum) and a series of polymers supplied by Allied Colloids.
- Chemical dosing locations - at in-line blender.

Generally all filter runs were terminated on head loss. The initial criteria in evaluating performance therefore, are:

- Run time to achieve a head loss of 2.5 m.


MULTI-TRAIN PERISTALTIC METERING PUMP
pH ADJUSTMENT
pH MEASUREMENT
VARIABLE ENERGY IN-LINE BLENDER & COAGULANT FEED
CEILING HEIGHT 4·5m
TWO-STAGE VARIABLE ENERGY FLOCCULATION
GRADUATED CYLINDERS FOR CHEMICAL STORAGE
ADJUSTABLE OVERFLOW TO VARY FLOCCULATION DETENTION TIME
PIEZOMETER TUBES FOR FILTER LOSS OF HEAD MEASUREMENT
RAW WATER INFLUENT ROTAMETER & FLOW CONTROL VALVE
SURFACE WASH NOZZLES
CONTINUOUS TURBIDITY MEASUREMENT & RECORDING
ADD'L. FLOW CONTROL VALVE & RAW WATER SAMPLING
SAMPLING PUMP
BACKWASH ROTAMETER & FLOW CONTROL VALVE
CLEARWELL
MICROMETER RATE ADJUSTMENT VALVE
TWO 100mm DIA. PLEXIGLASS FILTER COLUMNS
FLOAT OPERATED FILTER FLOW RATE CONTROL VALVE & ROTAMETER
FLOW CONTROL VALVE FOR DECLINING RATE FILTRATION

Pilot Water Treatment Plant

Direct Filtration Concept

Proctor & Redfern Limited
Consulting Engineers and Planners
Toronto

E.O. 81109

FIGURE No. 2

- Colour less than 5 TCU and turbidity less than 1.0 FTU for the duration of the run.

- Net reduction in turbidity across the filter for the duration of the run.

Colour removal is difficult to quantify for evaluation purposes and it was preferable to define acceptability on a qualitative basis of samples taken throughout the duration of the run. Head loss on the other hand is a more finite and less variable parameter that can be used to evaluate runs based on a non-dimensional Filter Index (F.I.) such as:

$$\text{F.I.} = \frac{\text{Run time (hrs.)} \times \text{Filter rate (m/hr.)}}{\text{Terminal Head Loss (m)}}$$

2.2.2 Pilot Test Results

The results of the pilot runs are shown in Figures 3-1 to 3-5 and 4.

From a review of the results, the following conclusions and comments can be made:

- Filtrate colour less than 5 TCU could only be achieved using alum as the sole coagulant, at dosages rates in the order of 30 mg/L.

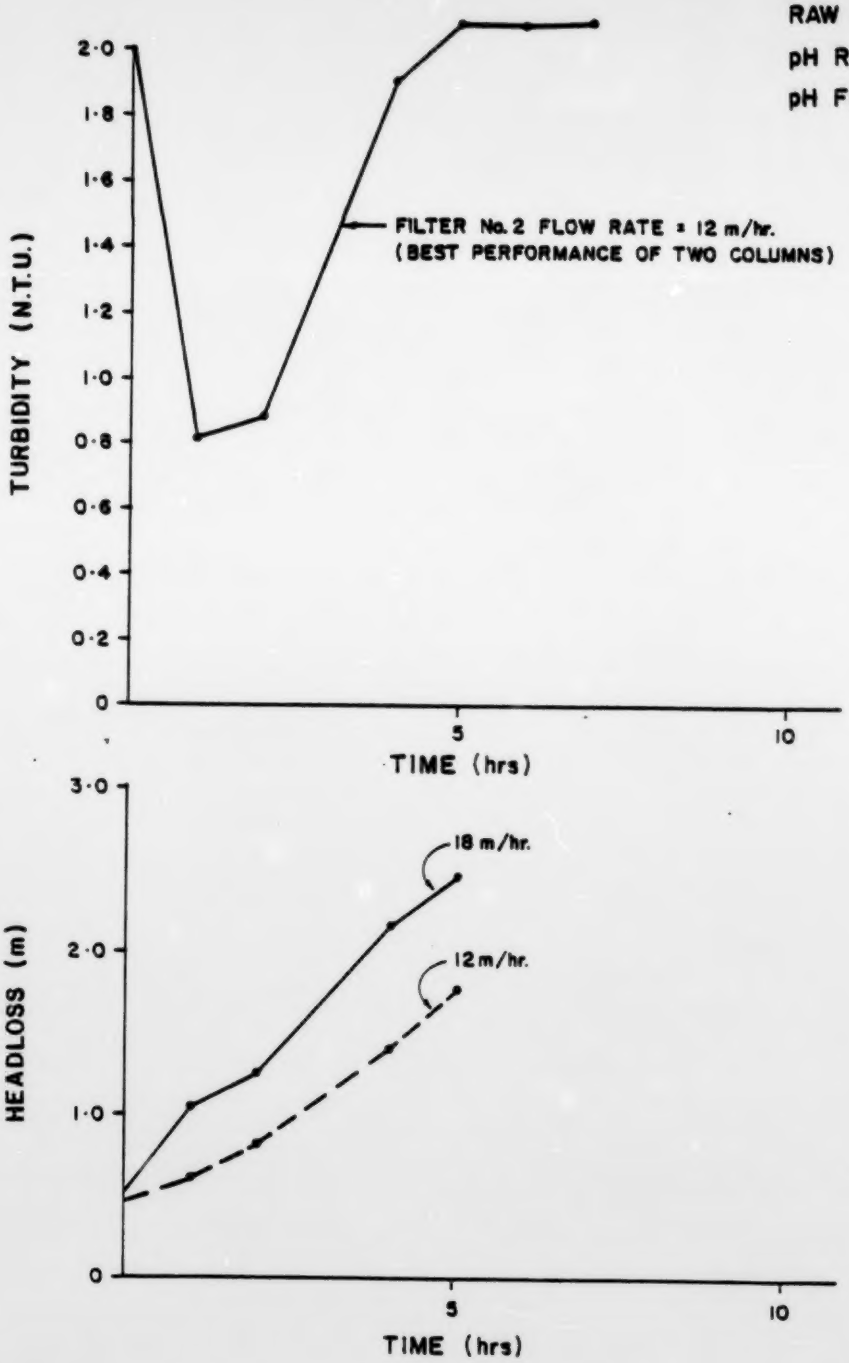
- Generally, filter run times were less than twelve hours, failing on head loss, where colour of less than 5 TCU was achieved. (See Figure Nos. 3-1 to 3-5).

- Coagulant dosage can be dramatically reduced if the pH of the raw water is corrected to 6.0 prior to addition of alum. (See Figure No. 4).

As indicated above, the addition of sulphuric acid, to reduce the pH to 6.0, significantly reduces the coagulant required to reduce the colour. At this pH the aluminum has its minimum solubility.

IMPERIAL

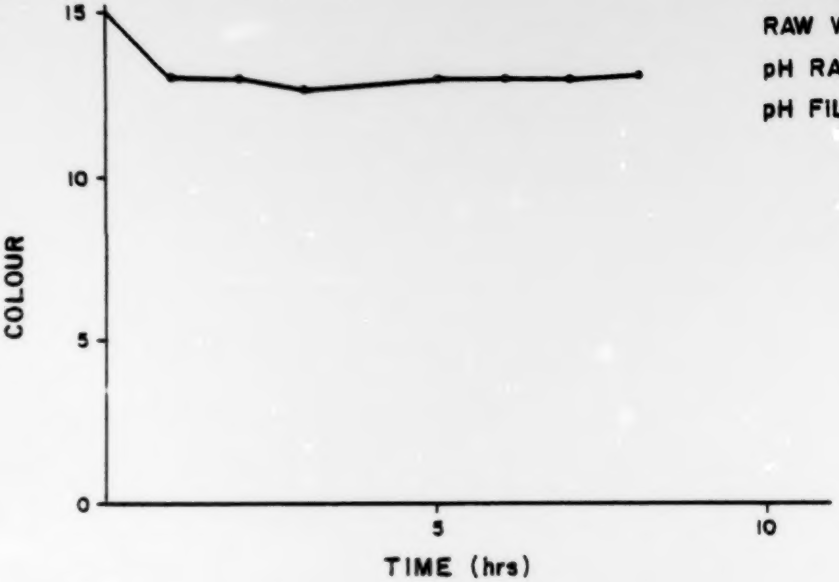
ALUM - 20 mg/L
RAW WATER TURBIDITY = 1·7 N.T.U.
pH RAW WATER = 7·1
pH FILTER EFFLUENT = 6·3

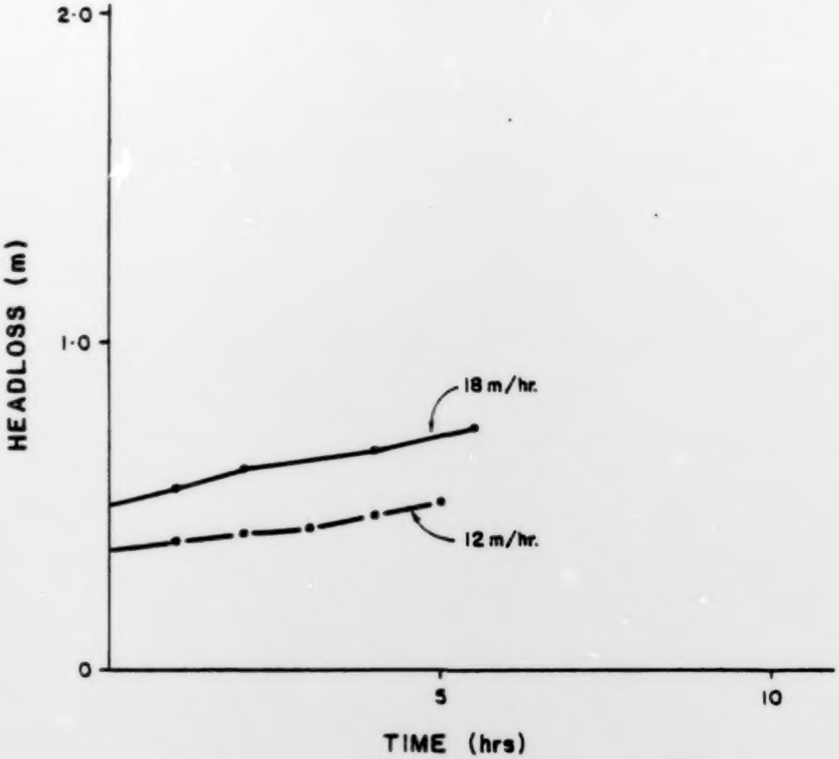


REVISIONS		
APPROVED BY	TOWN OF KIRKLAND LAKE WATER FILTRATION PLANT PRE - DESIGN REPORT	The Proctor & Redfern Group Consulting Engineers and Planners
	RUN 2	E.O. 81109 FIGURE No. 3 - 1

IMPERIAL

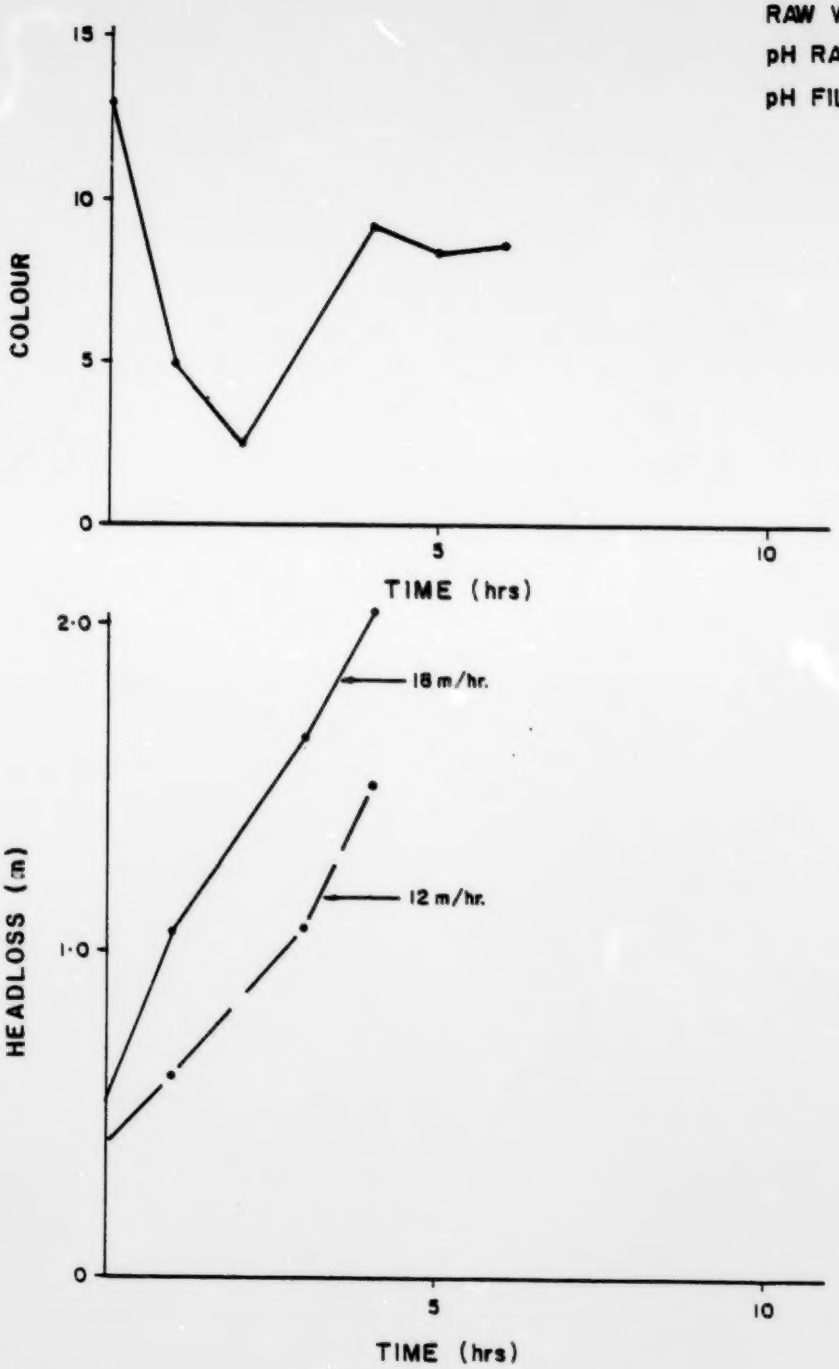
ALUM – 15 mg/L
RAW WATER TURBIDITY = 1·4 N.T.U.
RAW WATER COLOUR = 15
pH RAW WATER = 7·0
pH FILTER EFFLUENT = 6·5





REVISIONS			
APPROVED BY	TOWN OF KIRKLAND LAKE WATER FILTRATION PLANT PRE - DESIGN REPORT	The Proctor & Redfern Group Consulting Engineers and Planners	
	RUN 6	E.O. 81109	FIGURE No. 3 - 2

IMPERIAL



ALUM – 20 mg/L
RAW WATER COLOUR = 13
pH RAW WATER = 7·1
pH FILTER EFFLUENT = 6·3

REVISIONS	
APPROVED BY	TOWN OF KIRKLAND LAKE
	WATER FILTRATION PLANT PRE-DESIGN REPORT
	RUN 8

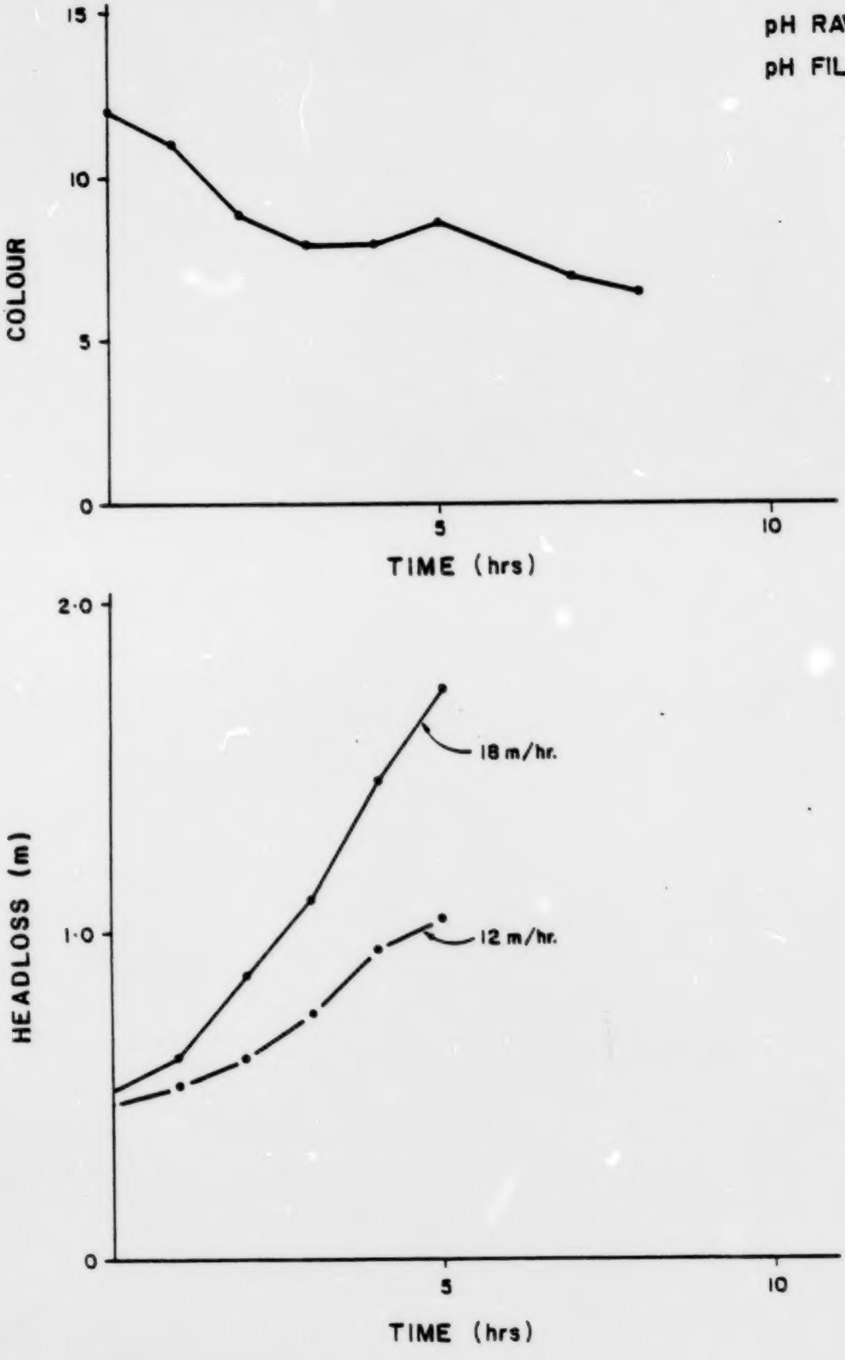
The Proctor & Redfern Group
Consulting Engineers and Planners

E.O. 81109

FIGURE No. 3-3

IMPERIAL

ALUM - 15 mg/L
LT 35 = 0·8 mg/L
pH RAW WATER = 7·2
pH FILTER EFFLUENT = 6·4



REVISIONS		
APPROVED BY	TOWN OF KIRKLAND LAKE	The Proctor & Redfern Group Consulting Engineers and Planners
	WATER FILTRATION PLANT PRE - DESIGN REPORT	
	RUN 12	E.O. 81109 FIGURE No. 3 - 4

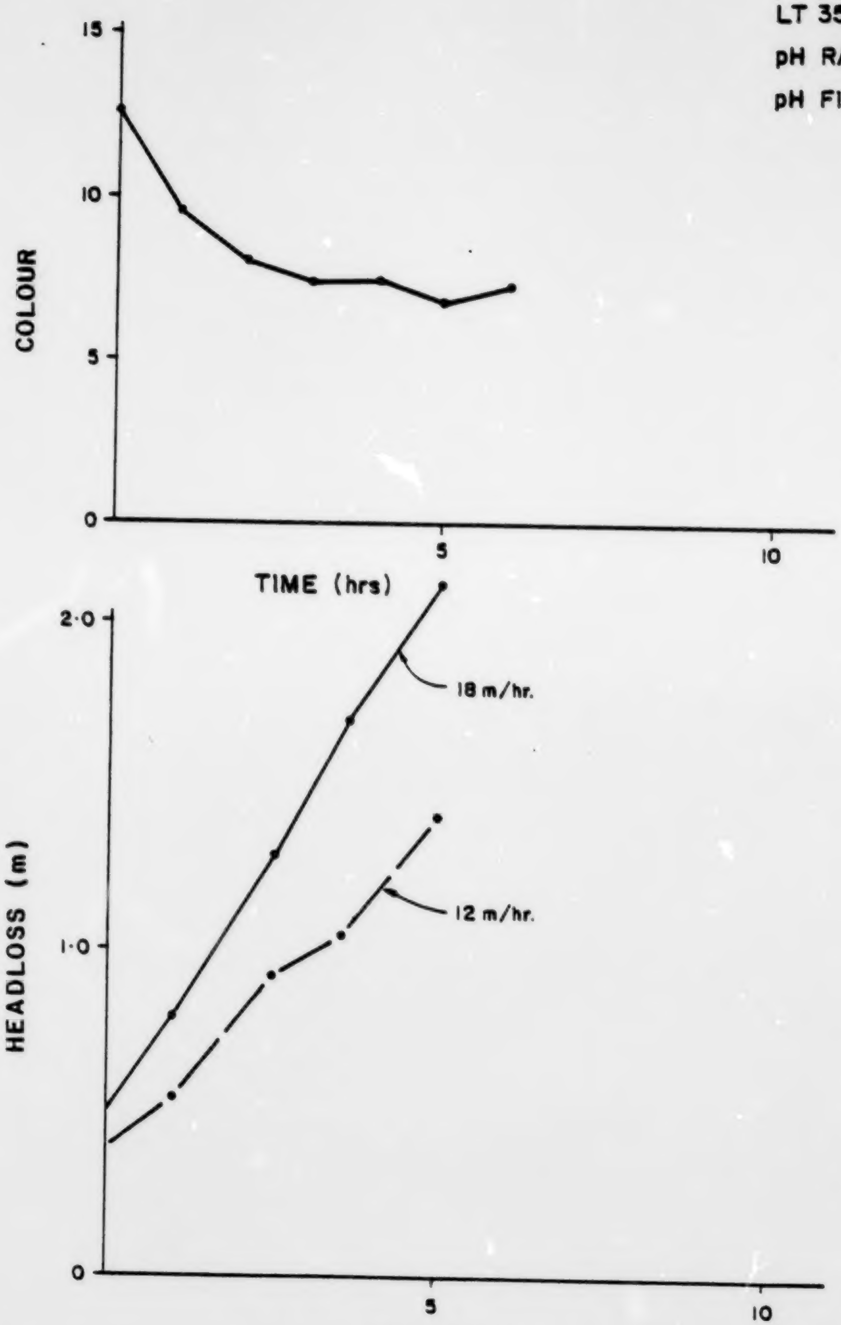
IMPERIAL

ALUM – 20 mg/L

LT 35 = 0·5 mg/L

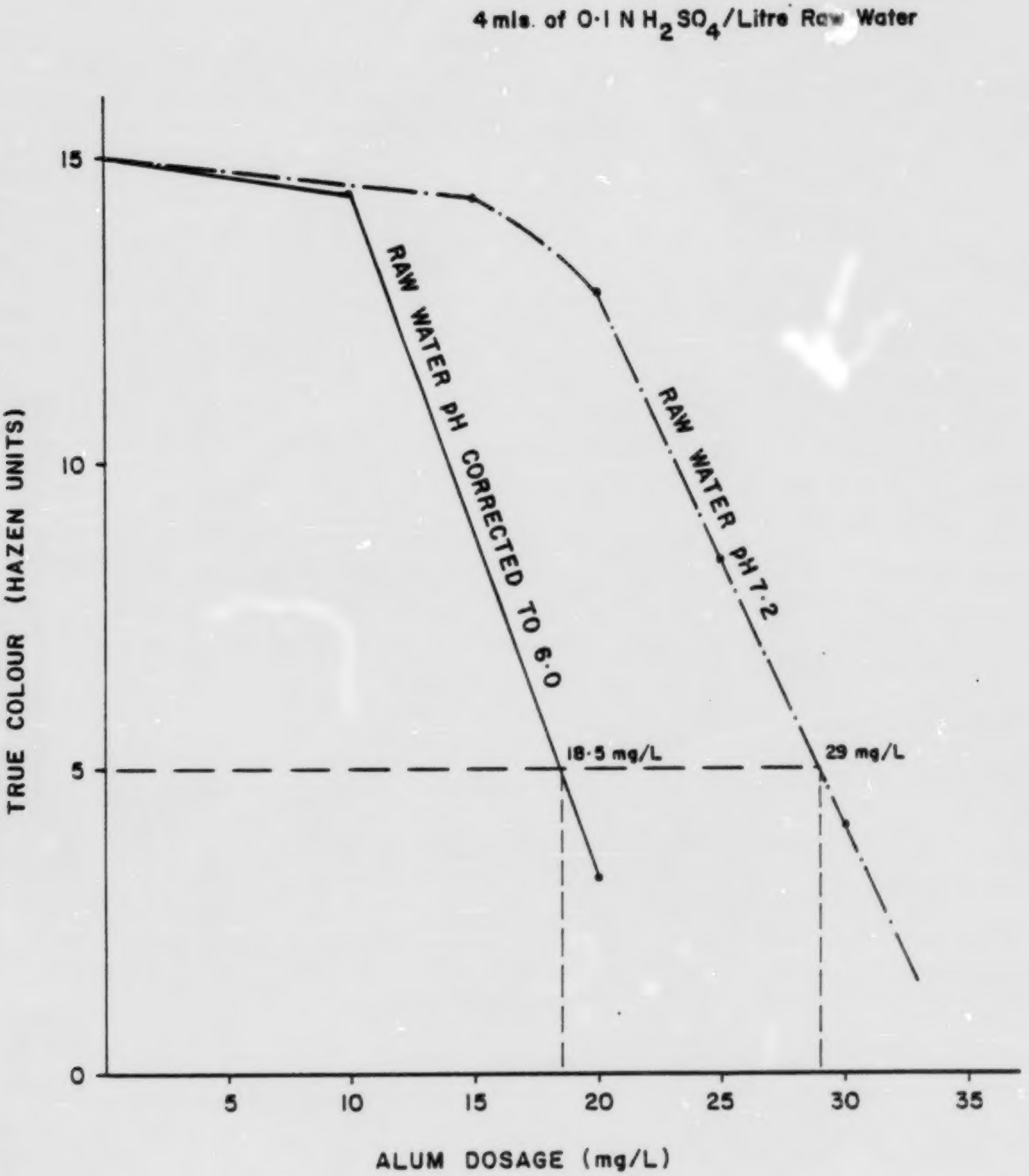
pH RAW WATER = 7·0

pH FILTER EFFLUENT = 6·6



REVISIONS			
APPROVED BY	TOWN OF KIRKLAND LAKE WATER FILTRATION PLANT PRE-DESIGN REPORT	The Proctor & Redfern Group Consulting Engineers and Planners	
	RUN 13	E.O. 81109	FIGURE No. 3-5

IMPERIAL



REVISIONS			
APPROVED BY	TOWN OF KIRKLAND LAKE	The Proctor & Redfern Group Consulting Engineers and Planners	
	WATER FILTRATION PLANT PRE - DESIGN REPORT		
	pH CORRECTION REQUIRED	E.O. 81109	FIGURE No. 4

Further direct filtration runs were therefore carried out with the lower initial pH and filter rate of 9 m/hr.

Generally all filter runs failed on turbidity breakthrough. Colour removal was readily achieved but even with the use of polymer as filter aids turbidity breakthrough occurred after 5 - 10 hours.

Polymer was used to strengthen the floc in order to prevent its breakdown on the filter media. However, such high dosages were required that even the best run of 8 hours before turbidity breakthrough also failed on headloss after 12 hours.

2.2.3 pH Test Results Using Acidification

From a review of these results the following conclusions and comments can be made:

- o Filtrate colour less than 5 TCU was readily achieved when the pH of the raw water was depressed to pH 6.0 and an alum dosage of 20 mg/L was used.
- o Polymer as a filter aid failed to extend filter run times.
- o All runs where colour was less than 5 TCU failed in less than 12 hours due to breakthrough.

2.2.4 Conclusions

As a result of the work carried out using the "direct filtration" process, several important conclusions were made. It was very difficult to obtain filter runs of more than 10 hours without termination due to turbidity breakthrough or headloss. The reason for this is probably due to the relatively high alkalinity of the water in comparison to other northern Ontario waters of lower alkalinity, which have been treated successfully using direct filtration techniques. The graph shown in Figure 5 shows the filter rates vs alkalinity for Northern waters. Point C is Gull Lake water and points A and B represent two other pilot studies we have carried out on other Northern Waters. The effect of acidification of the water is shown in Figure 4. As one can see with the adjustment of pH to levels in the region of 6.0 there is a substantial decrease in the amount of aluminum sulphate required to remove the same amount of colour. Although aluminum residual was not examined during this particular study, it would be expected that the aluminum residual in the acidified water would be much lower. These results led Proctor & Redfern to suggest that it was unlikely that direct filtration would be appropriate on Gull Lake water. In this case, Proctor & Redfern recommended that further research should be carried out on different treatment methods, using alternative chemical systems. These suggestions were formulated into a detailed proposal - Proposal No. 289RR entitled "Kirkland Lake Water Treatment Plant Alternative Process Research". This work was initiated on 4th November 1986.

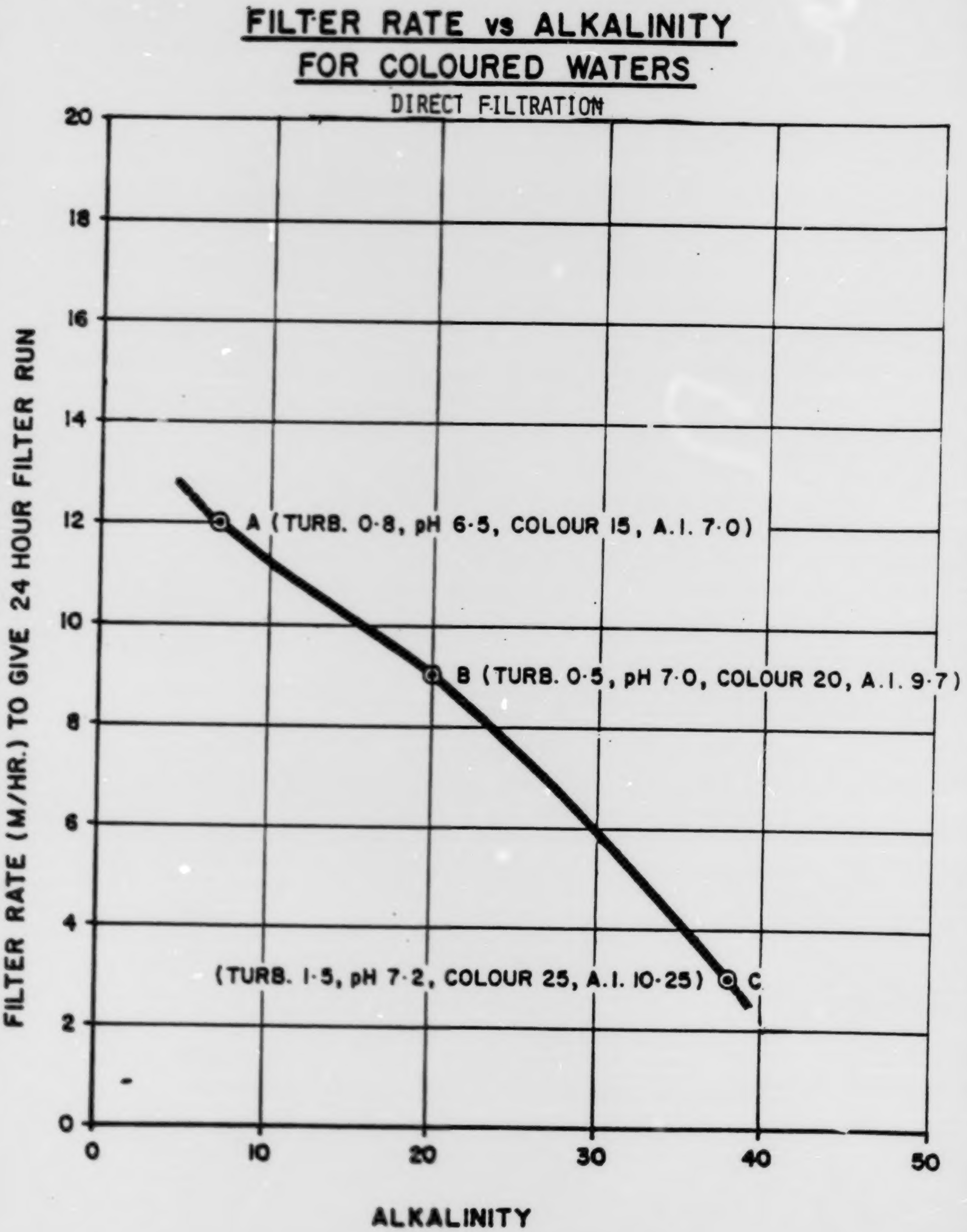

FILTER RATE vs ALKALINITY
FOR COLOURED WATERS
DIRECT FILTRATION
FILTER RATE (M/HR.) TO GIVE 24 HOUR FILTER RUN
20
18
16
14
12
10
8
6
4
2
0
A (TURB. 0·8, pH 6·5, COLOUR 15, A.I. 7·0)
B (TURB. 0·5, pH 7·0, COLOUR 20, A.I. 9·7)
(TURB. 1·5, pH 7·2, COLOUR 25, A.I. 10·25) C
0
10
20
30
40
50
ALKALINITY

FIGURE 5

3.0 ALTERNATIVE PROCESS RESEARCH

3.1 Introduction

As a result of the Ministry of the Environment's approval of the "Kirkland Lake Water Treatment Plant Alternative Process Research" - Proposal No. 289RR, by Proctor & Redfern, this study was initiated on November 4th, 1986.

The study of the existing plant data indicated six raw water conditions with which a water treatment plant would have to deal in order to provide acceptable water quality all year round. These parameters were:

- Colour
- Taste and Odour
- Iron (seasonal)
- Aggressive water
- Macroorganisms (at present intake)
- Turbidity

It was impossible to attempt to treat all of these conditions during the Kirkland Lake Pilot Study. Therefore we decided to treat the water during the period when the system demand is a maximum. During the winter months consumption of water is almost 60% more than that of the summer months. The main reason for higher demands is that the distribution system is set in rock and in order to prevent freezing the water must be kept constantly flowing in the system.

3.2 Jar Testing Studies

During December 1986 approximately 50-60 litres of water was transported from Gull Lake to the Proctor & Redfern Laboratory in Toronto and a series of jar tests were carried out on the Gull Lake raw water. The chemicals and methods of treatment of this water were agreed upon by Proctor & Redfern and the Ministry of the Environment.

The jar testing of the Gull Lake water was carried out over a period of two weeks in early December 1986. The effects of various dosages of chemicals were observed in these jar tests, based on standard methods, in order to produce a highly settleable floc. This work was carried out on cold water (2 - 5^{O}C) with low turbidity (0.4 FTU) and elevated colour (12 - 15 TCU).

The jar testing procedure was carried out in the following chronological order:

1. 1000 mL of water at 2^{O}C was added to 1.5 L jars.

2. The first coagulant was added and if more than one chemical was used in a test the second was added one minute thereafter, and the solution stirred at 100 rpm for 60 seconds.

3. After this period of time the stirring speed was reduced to 20 rpm and maintained at this speed for 25 minutes.

4. Stirring was stopped and the floc allowed to settle for 25 minutes.

5. Supernatant water was removed by pipette for analysis.

The primary coagulants used in the jar tests were Aluminum Sulphate, Poly Aluminum Chloride (PAC), Ferric Chloride, and Sodium Aluminate. The coagulant aids used were nonionic and anionic organic polymers. The jar tests were used as an indicator for assessing which chemicals could be used to treat the raw water during winter conditions to achieve optimum settling, colour and turbidity removal and residual aluminum results. The minimum effective dosage to give an acceptable supernatant was also ascertained.

The test results (see Tables 1 to 11 in Appendix A) showed that ferric chloride could be eliminated from the series of primary coagulants to be used on the pilot work since it imparted a high colour to the water. From the results of the testing of aluminum sulphate alone, it appeared that a substantial amount of chemical is required to remove colour from this water. It should also be noted that a number of factors were responsible for this behaviour, including the low temperature of the water and the higher than optimum pH of the water for alum coagulation.

High aluminum values were observed in all supernatants, with the exception of those whose pH were lowered by acid prior to alum coagulation, or those which had a pH of 6.0 - 6.3 as a result of the amount of coagulant added (ie. aluminum sulphate).

An assessment of each of the jar tests completed showed:

- Aluminum sulphate alone gave best colour removal at a dosage of 50 mg/L, turbidity was low, however the aluminum level was high at 0.31 mg/L. The pH of 6.5 was responsible for this level; by lowering the pH to 6.0 - 6.2 the aluminum level could be lowered to half this value.

- Polyaluminum chloride alone gave optimum results at a dosage of 40 mg/L. At this level the colour was reduced to 6 TCU and turbidity was 0.43 FTU, however, residual aluminum was present at 0.46 mg/L in the supernatant at a pH of 6.9. (Tests 2 and 3)

- Aluminum sulphate (30 mg/L) followed by polyaluminum chloride (35 mg/L) gave very good results with a colour of 3 TCU, a turbidity of 0.20 FTU and an aluminum residual of 0.10 in a supernatant of pH 6.4. (Test 4)

- Polyaluminum chloride, (30 mg/L), followed by aluminum sulphate, (35 mg/L), similarly gave water of 3 TCU but a higher turbidity of 0.41 FTU. The aluminum residual was less than 0.10 mg/L in water of pH 6.5. (Tests 5 and 10)

- Ferric chloride, (10 mg/L), gave colour of 8 TCU and turbidity of 0.54 FTU; the treated water had a pH of 6.17 (Test 6)

- Aluminum sulphate (20 mg/L) followed by the addition of sodium aluminate (15 mg/L) gave a colour of 2 TCU and a turbidity of 0.27 NTU. It should be noted that sodium aluminate (in the form of Hanfloc 45) must be added after the addition of the aluminum sulphate. Poor floc formation occurred when the sodium aluminate was added prior to the aluminum sulphate. (Tests 7 and 11)

- Aluminum sulphate at 30 - 40 mg/L followed by the use of Allied Colloids Percol LT20 (nonionic polymer) at 0.2 mg/L, or Allied Colloids Percol LT27 (high anionic) at 0.2 mg/L, showed an improvement over the use of aluminum sulphate alone at the same concentration from the standpoint of the turbidity value; colour removal was acceptable. (Test 8)

- Polyaluminum chloride and Allied Colloids Percol LT27 (high anionic) produced no floc at all. (Test 9)

- Polyaluminum chloride and LT20 gave a fairly good floc but little removal of colour. (Test 9)

Based on the results of these jar tests, a series of pilot plant runs were chosen as follows:

- Aluminum sulphate at 50 mg/L, 35 mg/L and 20 mg/L in order to find the optimum aluminum sulphate level where colour was reduced to 5 TCU and the residual aluminum levels were as low as possible.

- Aluminum sulphate followed by polyaluminum chloride.

- Polyaluminum chloride followed by aluminum sulphate.

- Aluminum sulphate followed by sodium aluminate (Hanfloc 45).

- Aluminum sulphate and polymer Percol LT20 or Percol LT27.

Finally, it should be mentioned that during the pilot plant operation, the chemical systems most likely to be successful were tried in Jar Tests and results discussed prior to pilot plant operation. However, in pilot plant operation, other chemicals were tried and tested and their results are reviewed in Section 5.

4.0 PILOT PLANT EQUIPMENT

4.1 Pielkenrood Plate Flocculator/Plate Separator

The raw water used in the jar tests and in the pilot tests was from the existing pumping station forebay. This location is shallow and is known to produce water of poor quality at certain times of the year. However, it was the only practical location to obtain water for the research work. The proposed water treatment plant will be located at a new site together with a new intake further out in the lake and at the maximum available depth.

The results of the jar tests showed that acceptable coagulants for the water from Gull Lake were aluminum sulphate, polyaluminum chloride, a combination of aluminum sulphate and polyaluminum chloride, aluminum sulphate and sodium aluminate.

These coagulants and others were used on the Pielkenrood Plate Flocculator unit. The system for this unit is shown on Figure 6. This system is a static plate flocculator with adjustable plate 'g' value, followed by a plate particle separator using corrugated plates at an angle of 60°.

The system was adapted to use contact flocculation ahead of the plate separator units and all chemicals were mixed by static mixers and without the use of mechanical devices. In this pilot plant chemicals were fed into the pipe carrying the raw water to the flocculator unit. Three such chemical feed points were present in this pipe in order to (a) vary the mixing time prior to coagulation and (b) enable a combination of three different chemicals to be added to the water. At each of these chemical feed points a static mixer was used which ensured a homogeneous solution of the chemical on arrival at the static plate flocculator. The plate flocculator contains several sets of plates which can be offset to maximize turbulence for efficient flocculation. After an effective residence time of 25 minutes in the flocculator plates and in the tank ahead of the separator plates, the flocculated water was carried into the plate separator. This separator consists of several corrugated plates inclined at an angle of 60° from the horizontal and thus has a settling area defined as:

$$A_{pt} = nAp \text{ Cos } a$$

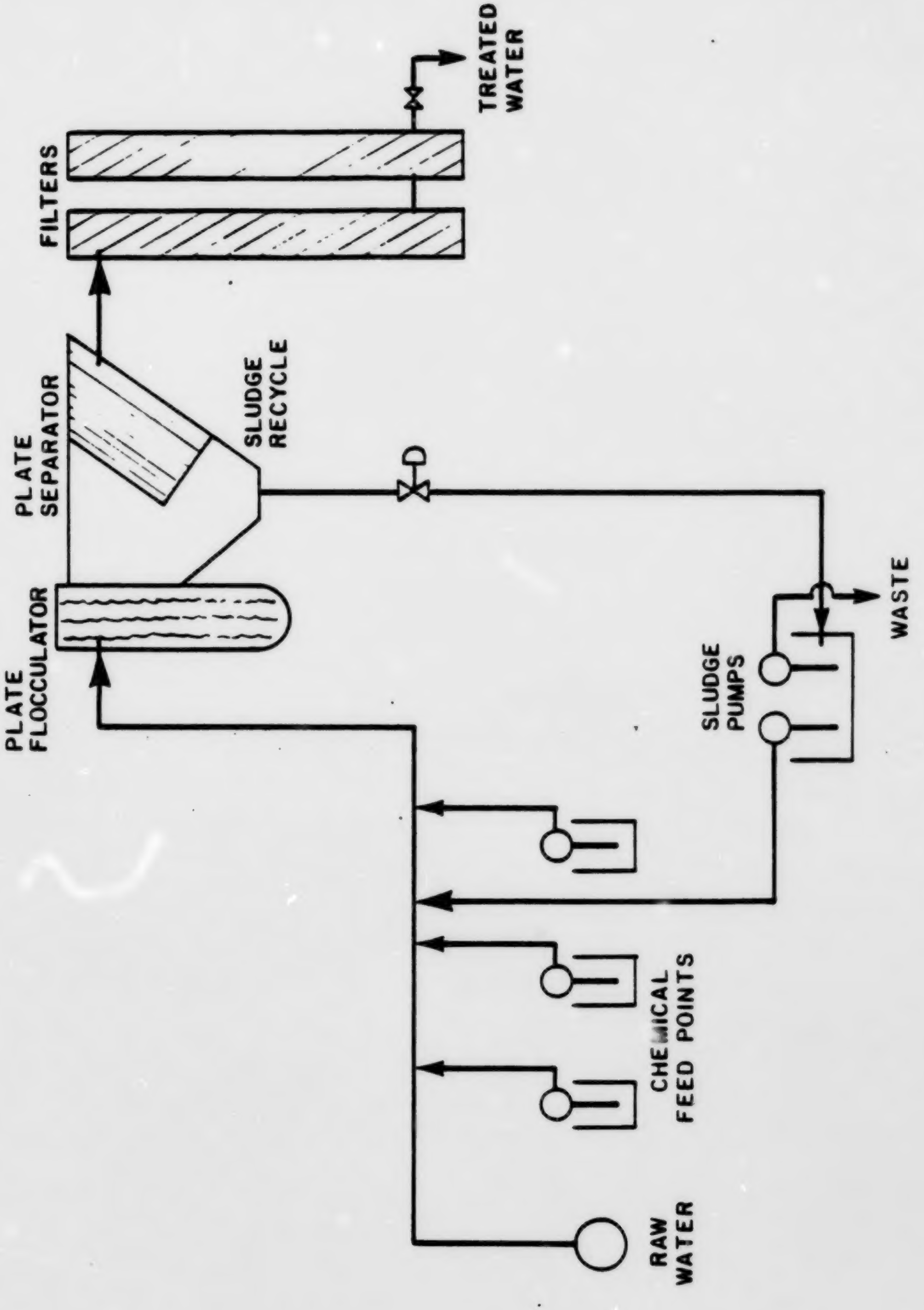
where A_{pt} = Total settling area available
n = Number of plates
Ap = Total area of plates
a = Angle of inclination

The plant was operated using a 5:1 sludge return ratio. Sludge return was used to enhance flocculation by seeding the incoming water and thus providing a substrate for the coalescing of floc particles. The sludge return ratio of 5:1 indicates a recycle rate of five times the sludge generated in the plant. This number can be varied but the 5:1 ratio has been found best for coloured waters. It was determined that this value was an optimum ratio based upon study on similar waters. The clear effluent from the plate separator was carried onto filters consisting of approximately 20 cm of sand and 55 cm of anthracite. The sand had an e.s. of 0.45 - 0.55 mm and the anthracite an e.s. of 0.85 - 0.95 mm. The final water was analyzed periodically for aluminum residual, colour, turbidity, pH, alkalinity and hardness. The headloss of the filters was also monitored every 1 to 2 hours.

The water from the separator was analyzed for colour, turbidity and pH. All on site results were corroborated by analyses carried out at the Ministry of the Environment Laboratories at Rexdale, Ontario.

Particle separation using inclined plates has been used for a number of years and is available from several suppliers. The Pielkenrood system consists of a combined process using both plate flocculation and separation. Flocculation energy can be varied by changing the plate offset and can be tapered. More recent applications use cross flow separators rather than upflow. This arrangement ensures that a maximum of plate surface area is contained in a minimum of space. Such units have been used throughout the world on highly coloured and very turbid waters and have produced excellent finished water quality.

PLATE FLOCCULATOR/PLATE SEPARATOR


TREATED WATER
FILTERS
PLATE SEPARATOR
SLUDGE RECYCLE
PLATE FLOCCULATOR
WASTE
SLUDGE PUMPS
CHEMICAL FEED POINTS
RAW WATER

Drawn by

Ckd. by

TOWN OF KIRKLAND LAKE

PIELKENROOD PLATE FLOCCULATOR / PLATE SEPARATOR – PILOT PLANT

Proctor & Redfern Limited
Consulting Engineers & Architect
Toronto

Scale

Date

FIGURE No. 6

4.2 Mechanical Flocculator/Plate Separator

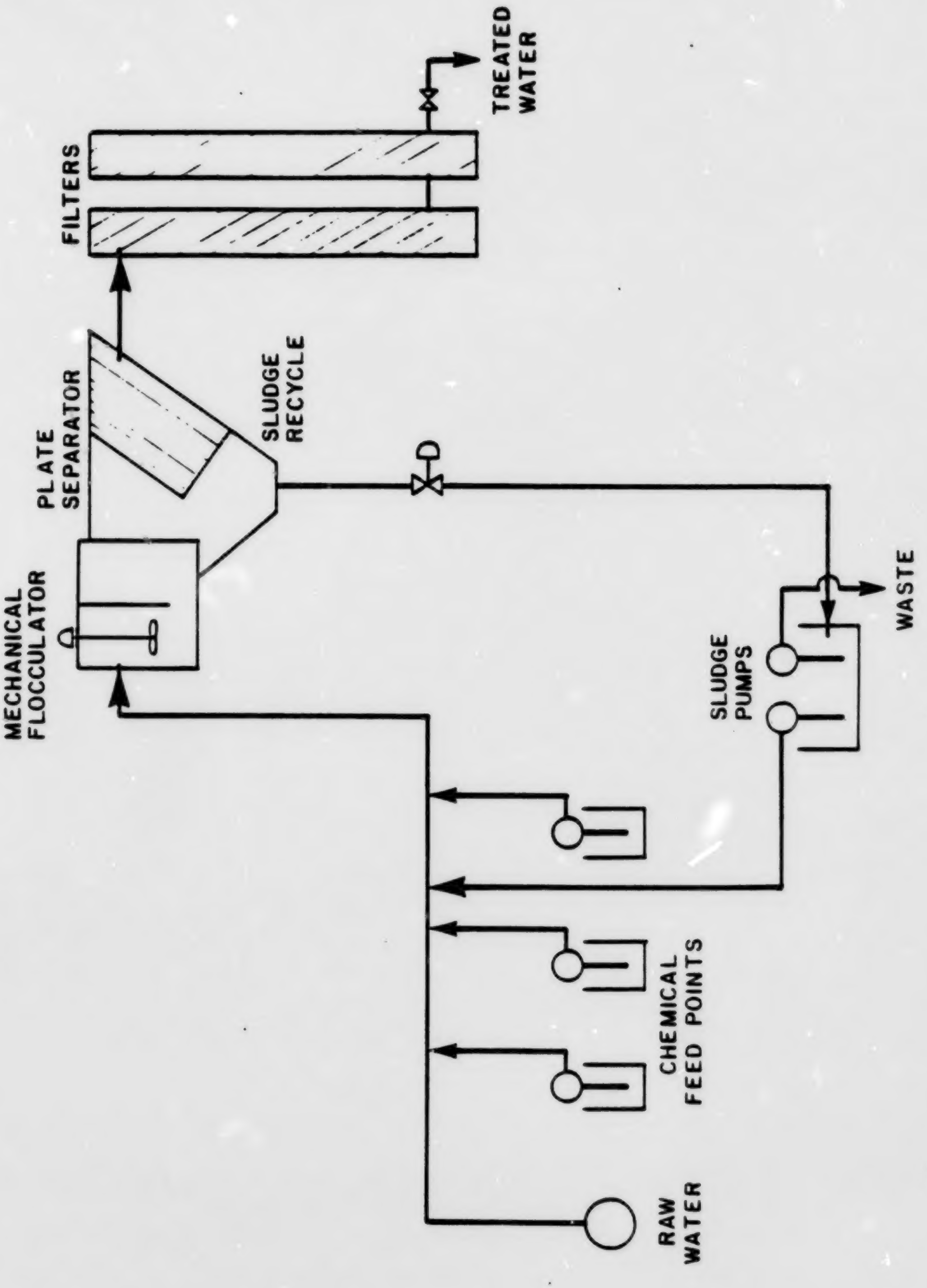
The pilot plant set up for mechanical flocculation/plate separation, shown in Figure 7, is similar to the Axel Johnson system piloted at the Lake Huron Water Supply System in 1983, (this work was performed for the removal of diatoms rather than colour). As can be seen from the diagram, the chemicals were mixed by static mixer and pass into a tank with flocculation energy (g) = $55S^{-1}$. The water then passes through a baffle system with a residence time in the tank of 25-50 minutes. The effluent is carried onto the plate separator, as in the Pielkenrood system, and floc is precipitated on the corrugated plates. This system also incorporated sludge recycling at a ratio of 5 to 1. The clear effluent is then filtered on the anthracite/sand filters. The water from the clarifiers was analyzed for colour, turbidity and pH. All on-site results were corroborated by analysis carried out at the Ministry of the Environment Laboratories at Rexdale, Ontario.

4.3 Trident System

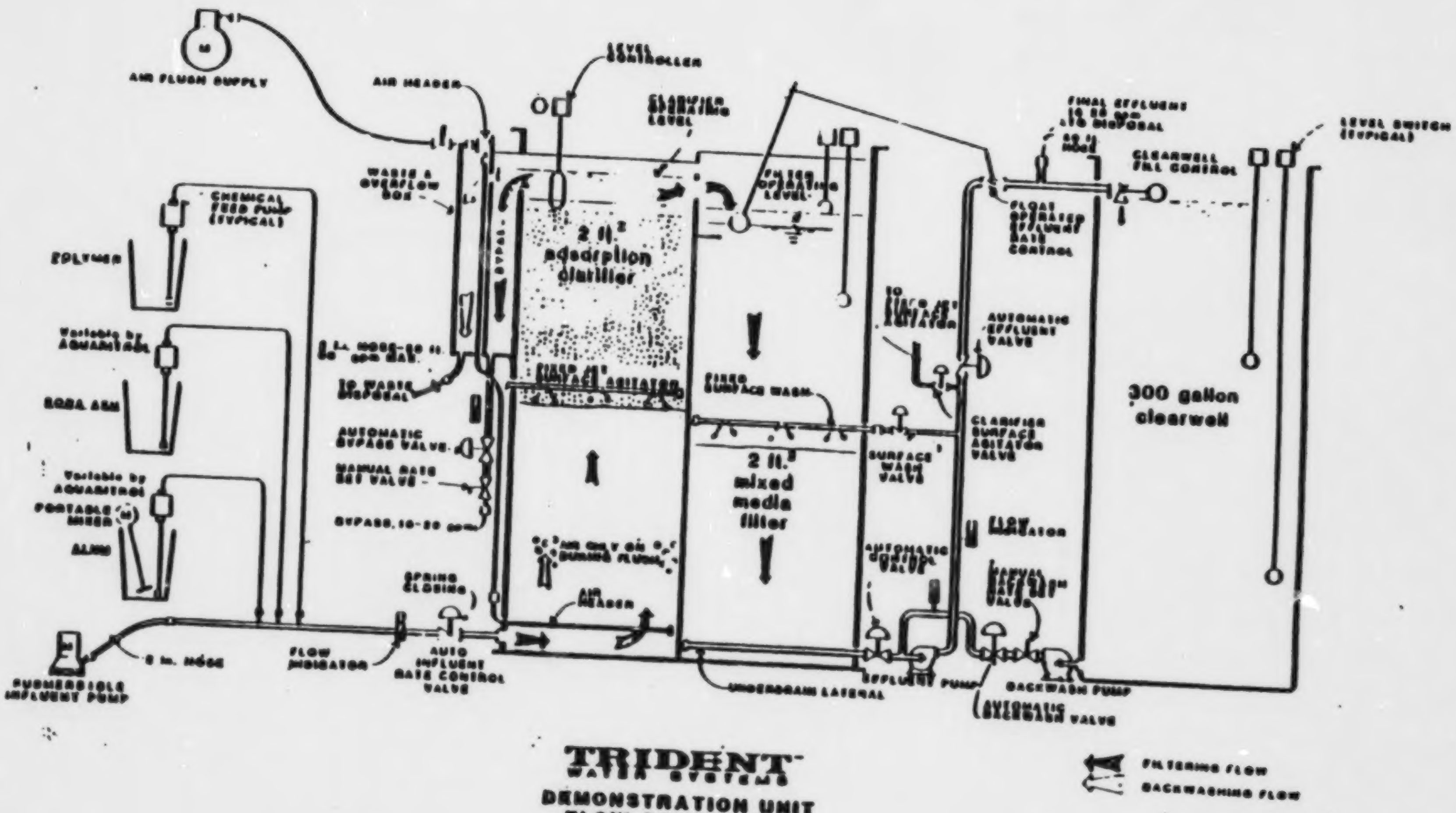
The Trident™ water treatment system was developed by Neptune Microfloc Inc. The system involves dosing the raw water with the chemical coagulants as it enters the plant. The water flows upwards through the Adsorption Clarifier, a solids separation device containing a buoyant media which traps and removes the coagulated particles as they pass through the media. The effluent passes over a weir and passes through a mixed media filter. A diagram showing this process is given in Figure 8. Figure 9 shows different modes of its operation.

An Aquaritrol process controller monitors coagulation by measuring the effluent turbidity and adjusts the coagulant feed in order to maintain the selected effluent quality. As a necessity of this process, heavy pin point floc is required to allow proper floc removal to occur. This is contrary to the other two pilot treatments which require a large strong floc to be formed. Further information on this system is given in Appendix C.

MECHANICAL FLOCCULATOR/PLATE SEPARATOR

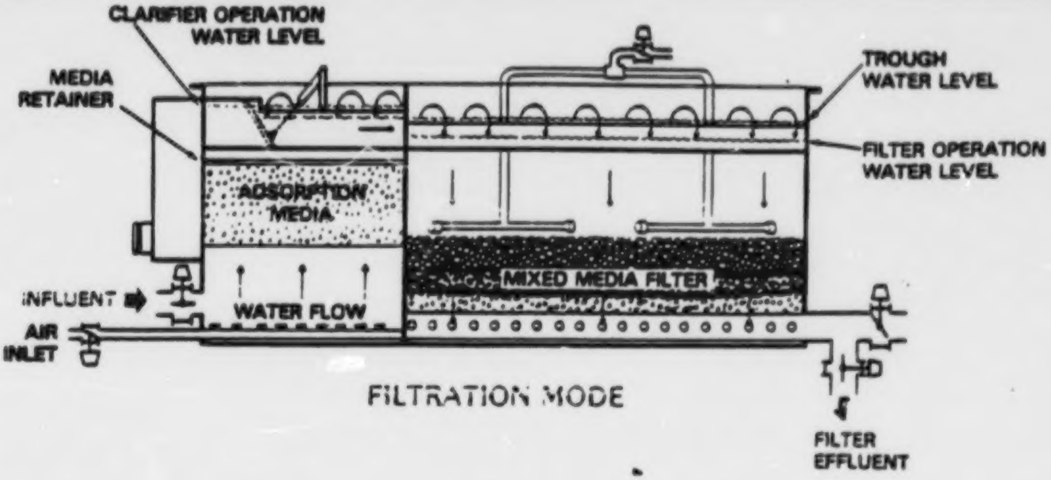

TREATED WATER
FILTERS
PLATE SEPARATOR
SLUDGE RECYCLE
MECHANICAL FLOCCULATOR
WASTE
SLUDGE PUMPS
CHEMICAL FEED POINTS
RAW WATER

Drawn by	TOWN OF KIRKLAND LAKE	Proctor & Redfern Limited Consulting Engineers & Architect Toronto
Ckd. by	MECHANICAL FLOCCULATOR/ PLATE SEPARATOR – PILOT PLANT	Scale | Date
		FIGURE No. 7

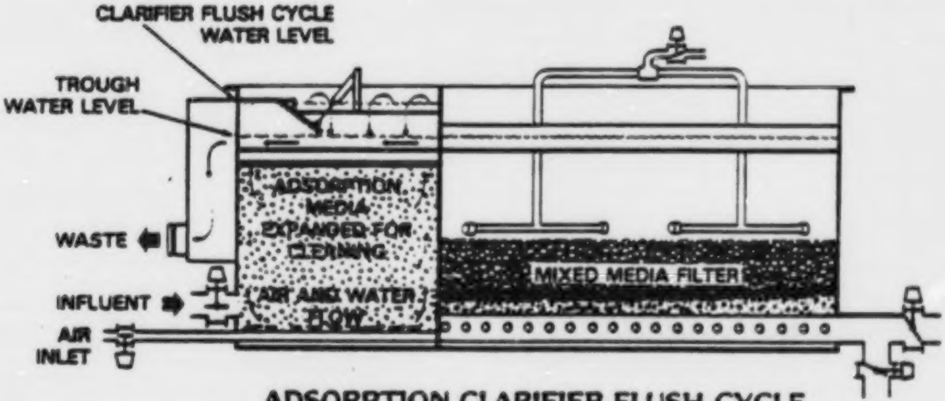

AIR FLUSH SUPPLY
AIR HEADER
LEVEL CONTROLLER
CLARIFIER OPERATING LEVEL
FILTER OPERATING LEVEL
FINAL EFFLUENT 10-20 gpm TO DISPOSAL
2 in. HOSE
CLEARWELL FILL CONTROL
LEVEL SWITCH (TYPICAL)
WASTE & OVERFLOW BOX
CHEMICAL FEED PUMP (TYPICAL)
POLYMER
Variable by AQUAMITROL
SODA ASH
Variable by AQUAMITROL
PORTABLE MIXER
ALUM
BYPASS
2 ft.²
adsorption clarifier
FIXED JET SURFACE AGITATOR
TO WASTE DISPOSAL
AUTOMATIC BYPASS VALVE
MANUAL RATE SET VALVE
BYPASS, 10-20 gpm
AIR ONLY OR AIR DURING FLUSH
AIR HEADER
FIXED SURFACE WASH
2 ft.²
mixed media filter
TO FIXED JET SURFACE AGITATOR
SURFACE WASH VALVE
AUTOMATIC EFFLUENT VALVE
FLOAT OPERATED EFFLUENT RATE CONTROL
CLARIFIER SURFACE AGITATOR VALVE
300 gallon clearwell
FLOW INDICATOR
AUTOMATIC CONTROL VALVE
MANUAL BACKWASH RATE SET VALVE
SPRING CLOSING
SUBMERSIBLE INFLUENT PUMP
2 in. HOSE
FLOW INDICATOR
AUTO INFLUENT RATE CONTROL VALVE
UNDERDRAIN LATERAL
EFFLUENT PUMP
BACKWASH PUMP
AUTOMATIC BACKWASH VALVE
FILTERING FLOW
BACKWASHING FLOW

TRIDENT
WATER SYSTEMS
DEMONSTRATION UNIT
FLOW SCHEMATIC

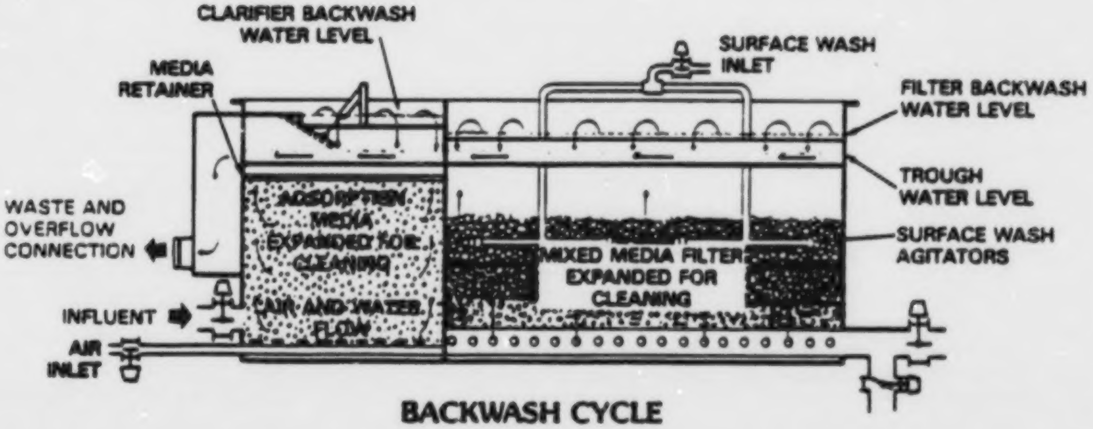
FIGURE 8


CLARIFIER OPERATION WATER LEVEL
MEDIA RETAINER
TROUGH WATER LEVEL
FILTER OPERATION WATER LEVEL
ADSORPTION MEDIA
MIXED MEDIA FILTER
INFLUENT
WATER FLOW
AIR INLET
FILTER EFFLUENT

FILTRATION MODE


CLARIFIER FLUSH CYCLE WATER LEVEL
TROUGH WATER LEVEL
WASTE
ADSORPTION MEDIA EXPANDED FOR CLEANING
MIXED MEDIA FILTER
INFLUENT
AIR AND WATER FLOW
AIR INLET

ADSORPTION CLARIFIER FLUSH CYCLE


CLARIFIER BACKWASH WATER LEVEL
MEDIA RETAINER
SURFACE WASH INLET
FILTER BACKWASH WATER LEVEL
TROUGH WATER LEVEL
SURFACE WASH AGITATORS
WASTE AND OVERFLOW CONNECTION
ADSORPTION MEDIA EXPANDED FOR CLEANING
MIXED MEDIA FILTER EXPANDED FOR CLEANING
INFLUENT
AIR AND WATER FLOW
AIR INLET

BACKWASH CYCLE

FIGURE 9

Neptune Microfloc, Inc.
P.O. Box 612
Corvallis, OR 97339
(503) 754-7654

neptune microfloc

DRAWN DATE	FLOW DIAGRAM		DRAWING NO	REV
COORDINATOR DATE				
CHECKED DATE	TRIDENT WATER SYSTEMS		M2181	1
APPROVED DATE			SHEET OF	

5.0 PILOT PLANT RESULTS

In this section the results of each pilot plant will be examined independently and the best results thoroughly analyzed in each. Similar treatments in different plants will also be compared. The pilot runs were continued until termination on headloss, continual poor turbidity or little colour removal. The criteria for evaluating performance were:

- Run time to achieve a headloss of 2.0 m.
- Filtrate quality maintained such that colour was 5 TCU or less.
- Turbidity less than 1.0 FTU for the duration of the run.

5.1 Pleikenrood Plate Flocculator/Plate Separator Results

5.1.1. General

There were a total of 39 runs carried out on the pilot system. An overview of the runs are shown in Table 12 in Appendix B.

Of the chemical coagulants tested the most promising primary coagulant was aluminum sulphate (alum). Alum was capable of removing colour from the Gull Lake water to levels less than 5 TCU. The problems encountered with this chemical alone were due to the strength or, more specifically, the lack of strength of the formed floc.

Using aluminum sulphate alone it can be seen from Table 12 Runs 1 to 4, 7 and 26 that as the dosage of aluminum sulphate is increased, the headloss time decreases and the time for turbidity breakthrough decreases. This was thought to be due to the coagulation and floc formation at higher than optimum pH. By lowering the pH with acid prior to the addition of aluminum sulphate the turbidity breakthrough time decreased and poor turbidity was observed throughout the run.

It was obvious from Run Nos. 1 to 4 on Table 12 that aluminum sulphate alone did not form a strong fast settling floc (as determined by the speed of breakthrough on the filters and hence loading upon the filters). It was therefore essential that various coagulant aids be used. The organic polymer coagulant aids used were Allied Colloids Percol LT20, LT27 and LT22S. Of these aids, Allied Colloid Percol LT20 caused early attainment of the 2m maximum headloss. The Allied Colloids Percol LT27 resulted in an early turbidity breakthrough, probably due to weak floc formation. Alum and Allied Colloids Percol LT22S gave good turbidity levels during the run, however, both the time of headloss attainment (2 m) and the time for turbidity breakthrough were less than desirable.

Alum and polyaluminum chloride (Sternpac), Runs 6, 15 to 21, 23, 27 and 29 were generally terminated by early turbidity breakthrough, with the time for the turbidity breakthrough being less than that of alum alone. This is indicative of poor floc strength.

Alum and activated silica gave the best results with a run which lasted 19 hours before turbidity breakthrough occurred. The time of this run would be expected to be extended on a full plant scale due to a longer residence time on such a scale. This would lead to better settling and thus less loading on the filters.

5.1.2. Chemical Dosage and Results

Using the plate flocculation/plate separation system the following chemical dosages were assessed.

With 30 mg/L alum (Run 3) a turbid water was formed in the clarifier which resulted in an overloading of the filters and caused an early breakthrough on turbidity. The colour of the finished water was good.

The addition of 10 mg/L alum and 0.05 mg/L Percol LT20 (Run 11) gave a low turbidity in the clarified water however, headloss readings were such that the run would end after 10 hours on attainment of 2 m headloss.

Sulphuric acid addition followed by the addition of 40 mg/L alum (Run 22) reduced the pH of the clarified water to 6.4. The turbidity of the water in the clarifier was still high at 3.10 FTU causing overloading of the filter and turbidity breakthrough to occur after 3 hours. The dissolved organic carbon and colour levels were significantly reduced by using this method.

Treatment with alum (25 mg/L) and polyaluminum chloride, 15 mg/L, (Run 27), gave a clarified water with high turbidity of 2.80 FTU which resulted in a fairly fast turbidity breakthrough on the filters. Run 33, which used 25 mg/L alum and 0.1 mg/L Percol LT27, gave a fairly low turbidity in the clarified water of 1.8 FTU however the turbidity of the filtered water was still high at 1.1 FTU.

The best chemical system using 25 mg/L alum and 1.5 mg/L activated silica in Run 37 gave clarified water with a turbidity of 1.4 FTU and the filters reduced this water to 0.37 FTU.

5.2 Mechanical Flocculator/Plate Separator Results

5.2.1. General

The runs carried out on the Pielkenrood System were duplicated using the mechanical flocculation/plate separation method. The location of the flocculation is shown on Figure No. 6 and the results are shown in Table 12, as Runs 40 to 45. In general, results using this method were poor and it is believed that the reason for this was due to the higher energy used for mixing. With the plate flocculation the gentler action prevents floc break up and therefore early turbidity breakthrough. Aluminum sulphate and activated silica gave poor turbidity throughout the run.

Aluminum sulphate and Percol LT27 also gave poor turbidity and short times to attain a headloss of 2 m, unlike the results of the plate flocculation/plate separation system.

5.2.2. Chemical Dosage and Results

A total of six runs were carried out using the mechanical flocculation plate separator unit. In each case the turbidity of the treated water increased as the run continued to give short run times. This effect was due to the formation of a weak floc in a turbulent environment. Treatment with alum (25 mg/L) and polyaluminum chloride, (15 mg/L) in Run 27 gave a clarified water with high turbidity of 2.80 FTU, which resulted in a fairly fast turbidity breakthrough on the filters. Run 33 which used 25 mg/L alum and 0.1 mg/L Percol LT27 gave a fairly low turbidity in the clarified water of 1.8 FTU however, the turbidity of the filtered water was still high at 1.1 FTU.

The best chemical system using 25 mg/L alum and 1.5 mg/L activated silica gave clarified water with a turbidity of 1.4 FTU and the filters reduced to 0.37 FTU.

5.3 Trident System

5.3.1. General

Of the three treatment systems studied the Trident^{TM} system was the most difficult to compare directly since it requires the formation of floc with characteristics significantly different from the other two more conventional treatment systems. For the Trident^{TM} system to operate effectively, it requires a small 'hard' floc whereas the two other systems need a large heavy floc. This difference in floc requirement caused problems during the early stages of the work when direct comparisons with the other two systems was attempted using equivalent chemical methods.

Eleven pilot runs were carried out on the Microfloc Trident system. The complete Microfloc report on this series of runs is included in Appendix C. The conclusion of the Microfloc report was that acceptable water could be produced using alum, Nalco 8105 and Magnafloc 985N. Other test runs using different treatment chemicals and chemical combinations were unsuccessful.

5.3.2. Chemical Dosage and Results

The initial pilot tests were run using aluminum sulphate in concentrations of 20, 30 and 40 mg/L, Microfloc Runs 2, 3 and 8, and in all cases filter breakthrough occurred within five hours. This was due to the formation of a heavy "soft" floc using only alum, which broke into smaller floc on the adsorption media.

The run utilizing polyaluminum chloride (Sternpac) at 25 ppm, Microfloc Run 10, gave a filter run which lasted ten hours. The formation of a stronger floc accounted for the longer filter run, although it should be recognized that colour was less effectively removed with polyaluminum chloride compared with aluminum sulphate.

Neptune Microfloc Inc. were given an opportunity to develop their own chemical treatment combination in order to produce a high quality water. A total of five runs were carried out with Microfloc using various dosages of aluminum sulphate, Nalco 8105 (cationic), and Magnifloc 985N (Nonionic). Nalco 8105 is a polyquaternary ammonium chloride and Magnifloc 985N is a nonionic polymer, a polyacrylamide. Some of these runs gave very good turbidity levels and long run times, of up to 42 hours.

Microfloc's selected chemicals, using the following dosages, aluminum sulphate (8 mg/L), Nalco 8105 (5 mg/L) and Magnifloc 985N (0.05 mg/L), gave a run time of 28.5 hours with a projection of 33 hours on headloss readings alone. This run length was exceeded using the same chemicals but the dosages were varied during the run and it was decided that the aforementioned run would be used as the best result. This chemical system produced a finished water with an average turbidity of 0.12 NTU, colour of 3 TCU and an aluminum residual of 0.05 mg/L.

The upflow clarifier was tested with various coagulants. The floc formed with alum, but without the use of polymers, gave poor results. This was due to the lack of cohesion of the floc as it passed-through the adsorption media of the upflow clarifier. When various coagulant and polymer combinations were used much better results were obtained. In run 6 of the Trident system, using alum at 8.7 mg/L, Nalco 8105N at

2.9 mg/L and Magnafloc 985 N at 0.05 mg/L, very good turbidity levels were obtained in the clarified water which resulted in the filters being required only to remove very low levels of turbidity. This resulted in long runs of up to 42 hours with termination due to 2 m headloss across the filter.

5.4 Physical and Chemical Analysis of Water from Pilot Runs

During the runs of all systems samples of water were removed from the raw, clarified and filtered water. These were analyzed at the Ministry of the Environment Laboratories in Rexdale. The results of these samples are shown in Appendix D.

In all cases, the water was found to be mildly aggressive with a Langelier Index from -0.95 to -2.7 which would indicate that post treatment of the water should be provided prior to distribution.

6.0 SUMMARY

Three pilot plant operations and results have been discussed in this report. All three plants use alternative technologies. Although the Pielkenrood plate flocculator and separator is used in Norway on waters of high colour (200 TCU) and on very turbid water in other locations, this equipment has not been applied to drinking water treatment in Canada. Other types of separators are used in the water treatment plant at Grand Bend (Lake Huron Water Supply) and are proposed at Lorne Park (South Peel Water System) and in the Region of Ottawa-Carleton. The more conventional method of flocculation uses mechanical flocculators and was also examined as a means of treatment of the Kirkland Lake water. The Neptune "Trident" system is a combined upflow clarifier and downflow filter system which has been installed at Temagami for the removal of colour from water and at Petrolia on turbid water. Since the units at Petrolia are not operating on low turbidity coloured water, operating data from this plant is not relevant to Kirkland Lake. The system in Temagami is oversized and only operates for one or two hours a day, thus a comparative evaluation can not be performed with this plant.

During this study we have attempted to compare the application of these three methods of water treatment during the period of maximum demand for the water which also coincides with the period of lowest temperatures.

The ideal floc to be produced in the mechanical and plate flocculators was large and heavy however, in this water the floc was also fragile and easily broken. For this reason, the plate flocculator worked better. In both of the plate separator systems, we suggest that the contact residence time be not less than two minutes between coagulation and flocculation. The multistage tapered flocculation available in the plate flocculator permits full energy variation. With maximum corrugation offset a 'g' value of $100S^{-1}$ can be obtained.

During the Pielkenrood system plant runs, the longest run obtained was for 19 h, at a filtration rate of 9 m/h, using aluminum sulphate (25 mg/L) and activated silica (1.5 mg/L). (This chemical treatment is currently used in Regional Ottawa-Carleton on a similar raw water). It is felt that the run could be extended considerably in a full scale plant. As the pilot plant was operated the activated silica was added through a chemical feed line. Such a method of activation is less effective than using an efficient system, such as an automatic activated silica feeder. However due to problems of scale formation inside the feed lines it was impossible to reduce the addition of activated silica to the levels required. During the operation of the Pielkenrood system and the mechanical flocculation and plate separation system there were occasions when floc formed on the filters. This occurred for two reasons:

1. the floc was broken into smaller floc by turbulence and passed through the clarification system.

2. incomplete flocculation occurred prior to clarification. This was due to insufficient mixing prior to flocculation or insufficient residence time in the plate flocculator.

Due to the short contact time, sludge recirculation was important in both the mechanical and plate flocculation methods particularly with the plate flocculators. Sludge recirculation decreases the flocculation time by seeding the floc and thereby reducing the time needed for floc growth. However, based on experience at other plants, we felt that due to the cold conditions and the chemistry of the water that a longer period of time was needed to give complete flocculation as outlined above. With the longer contact time and better chemical feed, we believe that filter runs in excess of 24 hours will be attained.

The Neptune "Trident" system relied upon the formation of a hard small floc which is removed in the upflow clarifier. This system produced good quality water with runs in excess of 24 hours using aluminum sulphate (8 mg/L), Magnafloc 986 N (0.05 mg/L) and Nalco 8105 (5 mg/L). Nalco 8105 is a polyquaternary ammonium polymer which gives the floc more strength and therefore provides a floc which is more resistant to the high shearing forces present in the media of the upflow clarifier. However, the upflow clarifier in the system has a very short contact time for flocculation. The unit requires regular flushing of the buoyant media approximately three times as frequently as filter backwashing. This involves passing air through the clarifier causing the media to drop releasing the entrapped floc which is flushed away.

The best runs for each of the three system were as follows:

Filtered Water

	Turbidity FTU	Colour TCU	Iron mg/L	Manganese mg/L	D.O.C. mg/L	Res. Al. mg/L	Time of Headloss (2m)	Time of Turbidity Breakthrough
Run #37 (Plate Flocculator)	0.37	4.5	0.110	0.038	3.0	0.056	19h	19h
Run #45 (Mech. Floc)	0.23	4.0	0.054	0.048	3.3	0.098	12.8h	<19h
Trident Run #6	0.31	4.0	0.01	0.005	4.1	0.036	42.5h	>42.5h

7.0 CONCLUSIONS

The Microfloc Trident System will produce good results on the Kirkland Lake water. However, for this application, its performance is very dependent on the use of polymers.

To date polymers have been used extensively and in many cases the effectiveness of water treatment plants is very dependent upon them. Currently the AWWA and NSF are reviewing the use of polymers as water treatment agents and in several countries certain polymers have been banned.

Activated silica is completely inorganic and its use is permitted up to 13 mg/L by EPA. Although in the past it has presented problems due to deactivation and incomplete mixing in water treatment these problems have, on the whole, been solved. Some countries use activated silica as a substitute for several polymers. However, activated silica will not produce the hard floc in a short contact time necessary for the proper operation of the Trident system.

The standard system using mechanical flocculation tends to be too harsh for the production of good flocs on coloured water. Better results were obtained with the static plate flocculator. The probable configuration would use three stage flocculation with a total flocculation retention time of 12 minutes and a total "gt" of 40,000 - 50,000.

The Pielkenrood plate separator is normally used in a cross flow configuration. This arrangement is very compact and, because of the large face area of the plate ends, has a low Reynolds Number. The flow is across the plate corrugations which act as sludge troughs to direct the sludge to the hopper bottoms of the tanks. While the plate loading rate of 0.60 m/hr is low compared with other plate units, the total loading available of up to 25 m/hr is considerably higher than the 8 - 10 m/hr total rate for other system due to the very compact plate arrangement.

Other plate systems could be considered but they would depend on mechanical flocculation since plate flocculators would only be offered by Pielkenrood for their plate system.

Using a filtration rate of 9.0 m/hr with the above pre-treatment system and aluminum sulphate and activated silica as coagulants we anticipate a good quality, colour free treated water.

Provision should be made for powdered activated carbon, for transient taste and odour problems, and also for control of the aggression of the finished water. Due to the alkalinity level, which is higher than most northern waters, the latter condition is not a serious problem.

APPENDIX A

JAR TESTING AND ANALYTICAL DATA

The following tables show the results of the jar tests carried out prior to the pilot testing, The parameters monitored were usually pH, turbidity, alkalinity, colour hardness, and aluminum levels.

In jar tests 8 to 11 the aluminum levels were not monitored.

KIRKLAND LAKE WATER TREATMENT
ALTERNATIVE PROCESS RESEARCH

TABLE I

TOWN OF KIRKLAND LAKE

Jar Test Results

DATE : 19 12 1986

	pH	Alkalinity (as CaCO3), mg/L	Turbidity (FTU)	Colour (TCU)	Hardness (as CaCO3), mg/L	Aluminum mg/L
RAW WATER	6.97	35	0.44	12	72	<.10

DATE : 19 12 1986

JAR TEST #1 using 0.5 % ALUMINUM SULFATE

SAMPLE #	ALUM DOSAGE	pH	Alkalinity (as CaCO3), mg/L	Turbidity (FTU)	Colour (T.C.U)	Hardness (as CaCO3), mg/L	Aluminum mg/L
CONTROL	-	7.11	36	0.43	12	70	<.10
2	10 mg/L	6.93	35	0.57	12	70	.66
3	20	6.89	37	0.73	11	70	.74
4	30	6.75	31	1.25	14	73	1.45
5	40	6.57	24	0.57	7	72	.62
6	50	6.49	27	0.34	5	75	.31

KIRKLAND LAKE WATER TREATMENT
ALTERNATIVE PROCESS RESEARCH

DATE : 19 12 1986

TABLE 2

JAR TEST #2 using STERNPAC (POLYALUMINUM CHLORIDE)

		Jar Test Results					
SAMPLE #	POLYALUMINUM CHLORIDE DOSAGE	pH	Alkalinity (as CaCO3), mg/L	Turbidity (FTU)	Colour (T.C.U)	Hardness (as CaCO3), mg/L	Aluminum mg/L
CONTROL	-	7.07	38	0.49	12	71	<.10
2	10 mg/L	6.99	35	0.41	11	71	.56
3	20	6.98	35	0.93	11	73	.62
4	30	6.85	33	0.75	12	70	.78
5	40	6.87	35	0.43	6	70	.46
6	50	6.65	32	0.45	8	70	.35

DATE : 22 12 1986

TABLE 3

JAR TEST #3 using ALUMINUM SULFATE & POLYALUMINUM CHLORIDE

			Jar Test Results					
SAMPLE #	ALUM DOSAGE	POLYALUMINUM CHLORIDE DOSAGE	pH	Alkalinity (as CaCO3), mg/L	Turbidity (FTU)	Colour (T.C.U)	Hardness (as CaCO3), mg/L	Aluminum mg/L
CONTROL	-	-	7.17	40	0.51	12	74	<.10
2	45 mg/L	-	6.39	18	0.43	4	71	.60
3	60	-	6.19	13	0.55	4	71	.17
4	75	-	5.79	8	0.85	5	71	1.66
5	-	60 mg/L	6.88	32	0.23	5	71	.54
6	-	75	6.77	28	0.21	5	71	.59

KIRKLAND LAKE WATER TREATMENT
ALTERNATIVE PROCESS RESEARCH

DATE : 22 12 1986

TABLE 4

JAR TEST # 4 using ALUMINUM SULFATE followed by POLYALUMINUM CHLORIDE

Jar Test Results

SAMPLE #	ALUM DOSAGE	POLYALUMINUM CHLORIDE DOSAGE	pH	Alkalinity (as CaCO3), mg/L	Turbidity (F.T.U)	Colour (T.C.U)	Hardness (as CaCO3), mg/L	Aluminum mg/L
CONTROL	-	-	7.11	40	0.39	12	72	<.10
2	15 mg/L	35 mg/L	6.71	27	0.32	4	72	.23
3	30	35	6.43	20	0.20	3	72	.10
4	45	35	6.30	14	0.23	3	74	.35
5	60	35	6.01	11	0.22	3	72	.36
6	75	35	5.66	8	0.50	3	73	.77

DATE : 23 12 1986

TABLE 5

JAR TEST 5 using POLYALUMINUM CHLORIDE followed by ALUMINUM SULFATE

SAMPLE #	ALUM DOSAGE	POLYALUMINUM CHLORIDE DOSAGE	pH	Alkalinity (as CaCO3), mg/L	Turbidity (F.T.U)	Colour (T.C.U)	Hardness (as CaCO3), mg/L	Aluminum mg/L
CONTROL	-	-	7.18	35	0.48	11	69	<.10
2	35 mg/L	15 mg/L	6.52	22	0.42	4	65	.15
3	35	30	6.49	19	0.41	3	66	<.10
4	35	45	6.38	18	0.45	3	70	.11
5	35	60	6.31	16	0.44	3	74	.13
6	35	75	6.21	14	0.53	4	68	<.10

KIRKLAND LAKE WATER TREATMENT
ALTERNATIVE PROCESS RESEARCH

DATE : 23 12 1986

TABLE 6

JAR TEST #6 using FERRIC CHLORIDE

Jar Test Results

SAMPLE #	FERRIC CHLORIDE DOSAGE	pH	Alkalinity (as CaCO3), mg/L	Turbidity (F.T.U)	Colour (T.C.U)	Hardness (as CaCO3), mg/L	Aluminum mg/L
CONTROL	-	7.16	39	0.45	11	70	<.10
5	5 mg/L	6.65	27	2.40	69	65	<.10
6	10	6.17	16	0.54	8	63	<.10

DATE : 23 12 1986

TABLE 7

JAR TEST #7 using ALUMINUM SULFATE followed by HANFLOC (SODIUM ALUMINATE)

Jar Test Results

SAMPLE #	ALUM DOSAGE	HANFLOC DOSAGE	pH	Alkalinity (as CaCO3), mg/L	Turbidity (F.T.U)	Colour (T.C.U)	Hardness (as CaCO3), mg/L	Aluminum mg/L
CONTROL	-	-	7.10	39	0.42	11	63	<.10
2	15 ppm	5 ppm	7.10	34	3.50	10	68	.29
3	20	7	7.03	33	0.81	7	62	.33
4	25	8	7.02	32	0.87	6	62	.32
5	30	10	6.99	30	0.80	5	64	.18
6	35	12	6.98	29	0.70	4	62	<.10

KIRKLAND LAKE WATER TREATMENT
ALTERNATIVE PROCESS RESEARCH

DATE : 30 12 1986

TABLE 8

JAR TEST #8 using ALUMINUM SULFATE & POLYMER (ALLIED COLLOIDS)

SAMPLE #	ALUM CONC.	POLYMER CONC.	pH	Alkalinity (as CaCO3), mg/L	Turbidity (F.T.U)	Colour (T.C.U)	Hardness (as CaCO3), mg/L
CONTROL	-	-	7.5	75	0.51	11	76
2	30 mg/L	LT 20 - .2 mg/L	6.8	51	0.47	5	66
3	30	LT 27 - .2 mg/L	6.8	52	0.54	5	62
4	30	LT 27 - .4 mg/L	6.7	49	0.41	4	65
5	40	LT 20 - .2 mg/L	6.6	42	0.51	4	68
6	40	LT 27 - .2 mg/L	6.6	42	0.42	3	61

TABLE 9

JAR TEST #9 using POLYMER (ALLIED COLLOIDS) & POLYALUMINIUM CHLORIDE

DATE : 08 01 1987

Jar Test Results

SAMPLE #	PAC DOSAGE	POLYMER DOSAGE	pH	Alkalinity (as CaCO3), mg/L	Turbidity (F.T.U)	Colour (T.C.U)
CONTROL	-	-				
2	20 mg/L	LT 20 - .2 mg/L	7.4	65	0.64	10
3	20	LT 27 - .2 mg/L	7.4	64	0.64	10
4	20	LT 27 - .4 mg/L	7.4	64	0.64	10
5	20	LT 20 - .25 mg/	7.3	66	0.60	9
6	20	LT 27 - .2 mg/L	73	65	0.60	9

DATE : 08 01 1987

TABLE 10

JAR TEST #10 using POLYALUMIUM CHLORIDE & ALUMINUM SULFATE

Jar Test Results

SAMPLE #	ALUM DOSAGE	PAC DOSAGE	pH	Alkalinity (as CaCO3), mg/L	Turbidity (F.T.U)	Colour (T.C.U)	Hardness (as CaCO3), mg/L
CONTROL	-	-	7.5	73	0.52	11	80
2	10 mg/L	10 mg/L	6.7	48	0.88	12	74
3	10	20	6.7	50	0.68	8	66
4	10	30	7.1	62	0.56	6	74
5	10	40	6.9	56	0.58	5	74
6	10	50	6.9	55	0.46	4	76

DATE : 08 01 1987

TABLE 11

JAR TEST # 11 using ALUMINUM SULFATE & HANFLOC (SODIUM ALUMINATE), WHERE ALUM AND HANFLOC WERE ADDED ALTERNATELY

Jar Test Results

SAMPLE #	ALUM DOSAGE	HANFLOC DOSAGE	pH	Alkalinity (as CaCO3)	Turbidity (N.T.U)	Colour (T.C.U)	Hardness (as CaCO3)
CONTROL	-	-	7.4	57	0.48	10	84
2*	30 mg/L	10 mg/L	7.3	47	0.49	3	75
3'	30	10	7.9	73	0.64	7	102
4*	20	15	6.8	37	0.27	2	84
5'	20	15	7.6	63	0.44	5	94
6*	35	12	7.4	48	0.33	2	83

* ALUM WAS ADDED FIRST
' HANFLOC WAS ADDED FIRST

APPENDIX B

PILOT PLANT OPERATING DATA

KIRKLAND LAKE - - ALTERNATIVE RESEARCH-RUN DATA

RUN	CHEMICAL DOSAGE	CHEMICAL DOSAGE	TIME OF HEADLOSS	TIME OF TURBIDITY BREAKTHROUGH	COLOUR	TURBIDITY	FILTER FLOW RATE	FILTER INDEX
1	ALUM - 45 mg/L		not reached	10 hr	0 TCU	<0.08 NTU	12 m/h	300
2	ALUM - 45 mg/L		not reached (31 hrs)	5.5	5	0.22	12 m/h	180
3	ALUM - 30 mg/L		not reached (31 hrs)	8.25	5	0.09	12 m/h	216
4	ALUM - 30 mg/L		not reached (12 hrs)	not reached	0	0.09	12 m/h	161
5	ALUM - 20 mg/L	HANFLOC - 12 mg/L	not reached (11.5 hrs)	2.5	5	0.58	12 m/h	84
6	ALUM - 12 mg/L	STERNPAC - 10 mg/L	not reached (46 hrs)	4.0	7	0.56	12 m/h	314
7	ALUM - 20 mg/L		not reached (14.8 hrs)	10.0	7	0.44	12 m/h	104
8	ALUM - 20 mg/L	LT 20 - 0.2 mg/L	4 hrs	filters fouled	3	0.10	12 m/h	36
9	ALUM - 20 mg/L	LT 20 - 0.05 mg/L	8 hrs	not reached	4	0.08	12 m/h	63
10	ALUM - 20 mg/L	LT 27 - 0.1 mg/L	not reached (11 hrs)	not reached	5	0.14	12 m/h	84
11	ALUM - 10 mg/L	LT 20 - 0.05 mg/L	not reached (9.8 hrs)	poor turbidity throughout run	5	0.38	12 m/h	64
12	ALUM - 10 mg/L	LT 20 - 0.05 mg/L	7 hrs	not reached	5	0.16	12 m/h	59
13	ALUM - 10 mg/L	HANFLOC - 5 mg/L	not reached (13.6 hrs)	not reached	5	0.25	12 m/h	103
14	ALUM - 10 mg/L	HANFLOC - 5 mg/L	not reached (13.9 hrs)	8.0	7	0.30	12 m/h	98
15	ALUM - 25 mg/L	STERNPAC - 15 mg/L	17 hrs	>12 hrs <15 hrs	5	0.17	12 m/h	136
16	ALUM - 20 mg/L	STERNPAC - 12 mg/L	not reached (16 hrs)	not reached	5	0.20	12 m/h	138
17	ALUM - 20 mg/L	STERNPAC - 20 mg/L	overnight (25.3 hrs)	< 11 hrs	7	0.20	12 m/h	72
18	ALUM - 20 mg/L	STERNPAC 15 mg/L LT 20 - 0.1 mg/L	3.1 hrs	not reached	5	0.08	12 m/h	29
19	STERNPAC - 50 mg/L	ALUM - 45 mg/L	21 hrs	21 hrs	5	0.20	12 m/h	313
20	ALUM - 20 mg/L	STERNPAC - 30 mg/L	leak in line	leak in line				
21	ALUM - 35 mg/L	STERNPAC - 30 mg/L	not reached (23.2 hrs)	3 hrs	5	0.26	12 m/h	138
22	H2SO4 0.02% VOL	ALUM - 40 mg/L	not reached (27.3 hrs)	3.3 hrs	5	0.14	6 m/h	10
23	ALUM - 25 mg/L	STERNPAC - 15 mg/L	overnight (24.5 hrs)	>12 hrs <15 hrs	5	0.08	6 m/h	88
24	ALUM - 35 mg/L	LT 22S - 0.05 mg/L	overnight (15.7 hrs)	>12 hrs <15 hrs	5	0.09	12 m/h	89
25	ALUM - 10 mg/L	NALCO 8105 - 5 mg/L	10.75 hrs	10.75 hrs	10	0.32	12 m/h	84
26	ALUM - 45 mg/L		2.5 hrs	poor turbidity throughout run	5	0.53	12 m/h	66
27	ALUM - 25 mg/L	STERNPAC - 15 mg/L	16.5 hrs	>12 hrs <15 hrs	5	0.20	12 m/h	90
28	ALUM - 45 mg/L	HANFLOC - 15 mg/L	(22.2 hrs)	poor turbidity throughout run	5	0.94	9 m/h	125
29	ALUM - 20 mg/L	STERNPAC - 20 mg/L	not reached (42.3 hrs)	>12 hrs <16 hrs	5	0.23	9 m/h	165
30	ALUM - 30 mg/L	LT 20 - 0.05 mg/L	19 hrs	4.7 hrs	5	0.28	9 m/h	108
31	ALUM - 25 mg/L	LT 27 - 0.03 mg/L	not reached (38.8 hrs)	7.5 hrs	5	0.25	9 m/h	162
32	ALUM - 25 mg/L	HANFLOC - 1.0 mg/L	not reached (33.2 hrs)	3 hrs	5	0.12	12 m/h	281
33	ALUM - 25 mg/L	LT 27 - 0.1 mg/L	not reached (33.7 hrs)	not reached	5	0.12	9 m/h	257
34	ALUM - 30 mg/L	LT 27 - 0.1 mg/L	19.7 hrs	>12 hrs <16 hrs	5	0.04	9 m/h	110
35	H2SO4 0.02% VOL	ALUM - 18 mg/L LT 27 - 0.07 mg/L	not reached	poor turbidity throughout run	10	0.67	9 m/h	1180
36	ALUM - 20 mg/L	H2SO4 0.5% VOL LT 27 - 0.07 mg/L	not reached (76.4 hrs)	poor turbidity throughout run	10	0.37	9 m/h	1146
37	ALUM - 25 mg/L	ACTIVATED SILICA - 1.5 mg/L	19 hrs	19 hrs	5	0.14	9 m/h	103
38	ALUM - 20 mg/L	ACTIVATED SILICA - 2.0 mg/L	overnight (11.5 hrs)	5 hrs	5	0.15	9 m/h	77
39	ALUM - 30 mg/L	LIME - 3.0 mg/L	16.7 hrs	>12 hrs < 17 hrs	5	0.17	9 m/h	101
40	ALUM - 25 mg/L	ACTIVATED SILICA - 2.0 mg/L	overnight (51 hrs)	poor turbidity throughout run	5	0.63	9 m/h	154
41	ALUM - 15 mg/L	ACTIVATED SILICA - 1.5 mg/L	not reached (21.8 hrs)	3 hrs (poor)	5	0.62	9 m/h	122
42	ALUM - 25 mg/L	ACTIVATED SILICA - 3.0 mg/L	not reached (27.8 hrs)	poor turbidity throughout run	7	0.66	9 m/h	145
43	ALUM - 25 mg/L	LT 27 - 0.15 mg/L	not reached (18.3 hrs)	poor turbidity throughout run	5	0.42	9 m/h	110
44	ALUM - 25 mg/L	LT 27 - 0.15 mg/L	overnight (12.1 hrs)	poor turbidity throughout run	5	0.49	9 m/h	83
45	ALUM - 20 mg/L	ACTIVATED SILICA - 2.0 mg/L	overnight (12.8 hrs)	>12 < 19 hrs	<5	0.14	12 m/h	128

*Figures in brackets are projected times to attain a headloss of 2 m

1.Hanfloc is Sodium Aluminate

2.Sternpac is Polyaluminum Chloride

3.Activated Silica was made with Sodium Silicate and Ammonium Sulphate

TABLE 13

TREATMENT PROCESS	TURBIDITY (NTU)		COLOUR (TCU)		RESIDUAL ALUMINUM (mg/L)		IRON (mg/L)	
	Raw	Tr.	Raw	Tr.	Raw	Tr.	Raw	Tr.
PLATE FLOCCULATION/ PLATE SETTLING								
Run 3 - 30 mg/L Alum	0.46	0.17	14.0	3.5	0.01	0.05	0.017	0.019
Run 11 - 10 mg/L Alum, 0.05 mg/L Percol	0.40	0.42	14.0	4.0		0.024	0.016	0.016
Run 22 - Acidification to pH 6.5, 40 mg/L Alum	0.40	0.14	14.5	2.5	0.011	1.10	0.020	0.031
Run 27 - 25 mg/L Alum, 15 mg/L PACl	0.30	0.20	15.5	5.0	0.019		0.032	0.015
Run 33 - 25 mg/L Alum, 0.1 mg/L Percol LT 27	0.40		16.5	3.5	0.19	0.14	0.10	0.10
Run 37 - 25 mg/L Alum, 1.5 mg/L Activated Silica	0.82	0.37	16.5	4.5	0.029	0.056	0.082	0.11
TRIDENT UPFLOW CLARIFIER								
Run 6	1.03	0.31	15.0	4.0	0.007	0.036	0.016	0.011
Run 7	0.45	0.56	14.0	4.5	0.012	0.029	0.024	0.010

TOWN OF KIRKLAND LAKE - ALTERNATIVE RESEARCH-RUN DATA

RUN 3 - TREATMENT 30 mg/L ALUM

RUN TIME - 8.25 HOURS

PARAMETER	RAW WATER	CLARIFIED WATER	FILTERED WATER
IRON (mg/L)	.017	.064	.019
MANGANESE (mg/L)	.007	.008	.007
ALUMINUM (mg/L)	.010	1.200	.050
ZINC (mg/L)	.003	.004	.006
SULPHATE (mg/L)	5.91	21.23	21.30
TURBIDITY (NTU)	.46	2.80	.17
COLOUR (TCU)	14.0	5.0	3.5
DISSOLVED ORGANIC CARBON (mg/L)	5.6	3.2	2.9
LANGLIER'S INDEX	-.77	-1.69	-1.69
CONDUCTIVITY 25C UMHOS/CM	149.0	158.0	154.0
HARDNESS, TOTAL mg/L	50.5	45.0	44.5
ALKALINITY mg/L	40.4	26.1	24.6
PH	7.72	7.04	7.07
CHLORIDE mg/L	16.10	15.90	16.10

TOWN OF KIRKLAND LAKE - ALTERNATIVE RESEARCH-RUN DATA

RUN 11 - TREATMENT 10 mg/L ALUM & 0.05 mg/L PERCOL LT 20

RUN TIME - 9.8 HOURS

PARAMETER	RAW WATER	CLARIFIED WATER	FILTERED WATER
IRON (mg/L)	.016	.033	.016
MANGANESE (mg/L)	.016	.015	.015
ALUMINUM (mg/L)	<.004	.290	.024
ZINC (mg/L)	.006	.020	.008
SULPHATE (mg/L)		14.02	14.60
TURBIDITY (NTU)		1.01	.42
COLOUR (TCU)		4.0	4.0
DISSOLVED ORGANIC CARBON (mg/L)		4.0	3.9
LANGLIER'S INDEX	-	-	-
CONDUCTIVITY 25C UMHOS/CM		153	152
HARDNESS, TOTAL mg/L		49.0	48.0
ALKALINITY mg/L		32.9	32.2
PH		7.72	7.11
CHLORIDE mg/L		17.30	17.30

TOWN OF KIRKLAND LAKE - ALTERNATIVE RESEARCH-RUN DATA

RUN 22 - TREATMENT H_2SO_4 followed by 40 mg/L ALUM

RUN TIME - 27.3 HOURS

PARAMETER	RAW WATER	CLARIFIED WATER	FILTERED WATER
IRON (mg/L)	.020	.130	.031
MANGANESE (mg/L)	.022	.019	.036
ALUMINUM (mg/L)	.011	3.00	1.10
ZINC (mg/L)	.006	.009	.028
SULPHATE (mg/L)	11.12	39.73	38.68
TURBIDITY (NTU)	.40	3.10	0.04
COLOUR (TCU)	14.5	1.5	2.5
DISSOLVED ORGANIC CARBON (mg/L)	5.6	2.4	2.3
LANGLIER'S INDEX	-.93	-2.72	-2.54
CONDUCTIVITY 25C UMHOS/CM	149	168	168
HARDNESS, TOTAL mg/L	40.0	49.0	48.5
ALKALINITY mg/L	39.9	9.7	10.90
pH	7.59	6.40	6.54
CHLORIDE mg/L	17.30	16.90	16.80

TOWN OF KIRKLAND LAKE - ALTERNATIVE RESEARCH-RUN DATA

RUN 27 - TREATMENT 25 mg/L ALUM & 15 mg/L POLYALUMINUM CHLORIDE

RUN TIME - <15 HOURS

PARAMETER	RAW WATER	CLARIFIED WATER	FILTERED WATER
IRON (mg/L)	.032	.090	.015
MANGANESE (mg/L)	.032	.033	.033
ALUMINUM (mg/L)	.019	2.30	.190
ZINC (mg/L)	.003	.005	.034
SULPHATE (mg/L)	8.49	21.18	19.83
TURBIDITY (NTU)	.30	2.80	.20
COLOUR (TCU)	15.5	5.5	5.0
DISSOLVED ORGANIC CARBON (mg/L)	6.3	4.1	3.7
LANGLIER'S INDEX	-.86	-1.57	-1.45
CONDUCTIVITY 25C UMHOS/CM	149.00	161.0	160.0
HARDNESS, TOTAL mg/L	48.0	48.0	48.0
ALKALINITY mg/L	40.2	27.2	28.6
PH	7.66	7.12	7.22
CHLORIDE mg/L	17.70	17.30	17.40

TOWN OF KIRKLAND LAKE - ALTERNATIVE RESEARCH-RUN DATA

RUN 33 - TREATMENT 25 mg/L ALUM & 0.1 mg/L PERCOL LT27

RUN TIME - 33.7 HOURS

PARAMETER	RAW WATER	CLARIFIED WATER	FILTERED WATER
IRON (mg/L)	.100	.120	.100
MANGANESE (mg/L)	.093	.035	.034
ALUMINUM (mg/L)	.019	1.200	.140
ZINC (mg/L)	.003	.008	.050
SULPHATE (mg/L)	9.5	30.77	30.77
TURBIDITY (NTU)	.40	1.80	0.12
COLOUR (TCU)	16.5	4.0	3.5
DISSOLVED ORGANIC CARBON (mg/L)	6.3	2.6	2.6
LANGLIER'S INDEX	-.96	-2.18	-2.17
CONDUCTIVITY 25C UMHOS/CM	153.0	165.0	166.0
HARDNESS,TOTAL mg/L	48.5	49.0	49.5
ALKALINITY mg/L	40.8	18.4	19.0
pH	7.55	6.68	6.67
CHLORIDE mg/L	17.4	17.3	17.40

TOWN OF KIRKLAND LAKE - ALTERNATIVE RESEARCH-RUN DATA

RUN 37 - TREATMENT 25 mg/L ALUM & 1.5 mg/L ACTIVATED SILICA

RUN TIME - 19 HOURS

PARAMETER	RAW WATER	CLARIFIED WATER	FILTERED WATER
IRON (mg/L)	.082	.310	.110
MANGANESE (mg/L)	.110	.040	.038
ALUMINUM (mg/L)	.029	1.300	.056
ZINC (mg/L)	.001	.004	.032
SULPHATE (mg/L)	5.00	28.70	29.70
TURBIDITY (NTU)	.82	1.42	.37
COLOUR (TCU)	16.0	5.5	4.5
DISSOLVED ORGANIC CARBON (mg/L)	7.0	3.3	3.0
LANGLIER'S INDEX	-.90	-1.80	-1.60
CONDUCTIVITY 25C UMHO/CM	151.0	167.0	166.0
HARDNESS,TOTAL mg/L	50.0	49.0	50.0
ALKALINITY mg/L	40.8	23.8	21.2
pH	7.57	6.97	7.16
CHLORIDE mg/L	16.70	16.10	16.70

TOWN OF KIRKLAND LAKE - ALTERNATIVE RESEARCH-RUN DATA

TRIDENT RUN 6

RUN TIME - 42.5 HOURS

TREATMENT- ALUM 8.7 mg/L
NALCO 8105 cationic polymer 3.0 mg/L
MAGNOFLOC 985N non-ionic polymer 0.05 mg/L

PARAMETER	RAW WATER	CLARIFIED WATER	FILTERED WATER
IRON (mg/L)	.016	.015	.011
MANGANESE (mg/L)	.007	.005	.005
ALUMINUM (mg/L)	.007	.180	.036
ZINC (mg/L)	.004	.003	.008
SULPHATE (mg/L)	6.47	9.80	9.33
TURBIDITY (NTU)	1.03	1.14	.31
COLOUR (TCU)	15.0	4.5	4.0
DISSOLVED ORGANIC CARBON (mg/L)	5.8	-	4.1
LANGLIER'S INDEX	-	-	-
CONDUCTIVITY 25C UMHOS/CM	147.0	152.0	152.0
HARDNESS, TOTAL mg/L	48.5	48.5	49.0
ALKALINITY mg/L	38.7	35.9	35.9
PH	7.72	7.62	7.65
CHLORIDE mg/L	16.80	16.8	17.40

TOWN OF KIRKLAND LAKE - ALTERNATIVE RESEARCH-RUN DATA

TRIDENT RUN 7

RUN TIME - 30 HOURS

TREATMENT:
ALUM - 8.7 mg/L
NALCO 8105 cationic polymer - 3.0 mg/L

PARAMETER	RAW WATER	CLARIFIED WATER	FILTERED WATER
IRON (mg/L)	.024	.020	.010
MANGANESE (mg/L)	.011	.006	.004
ALUMINUM (mg/L)	.012	.370	.029
ZINC (mg/L)	.008	.012	.005
SULPHATE (mg/L)	6.77	11.34	11.76
TURBIDITY (NTU)	.45	.63	.56
COLOUR (TCU)	14.0	2.5	4.5
DISSOLVED ORGANIC CARBON (mg/L)	6.0	4.6	4.5
LANGLIER'S INDEX		-.95	
CONDUCTIVITY 25C UMHOS/CM	147.0	180.0	179.0
HARDNESS, TOTAL mg/L	49.0	47.0	48.0
ALKALINITY mg/L	39.1	36.3	37.0
pH	7.83	7.63	7.58
CHLORIDE mg/L	16.70	25.10	24.60

APPENDIX C

NEPTUNE-MICROFLOC REPORT ON TRIDENT SYSTEM

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I. INTRODUCTION

At Kirkland Lake, Ontario the water is a surface source from Gull Lake. The water is of low turbidity and color.

The purpose of the pilot study was to evaluate the TRIDENT® treatment process with respect to turbidity and color removal under "cold" water conditions.

II. SUMMARY AND CONCLUSIONS

The test protocol defined the following specific goals to be accomplished while onsite which are as follows:

1. Product effluent quality of having a turbidity of less than 0.25 NTU and color of less than 5 units.
2. Maximize filter runs and net production.
3. Determine chemical feed requirements.

Various chemical treatment chemicals were tested by observing their performance in the Adsorption Clarifier™ and mixed-media filter. The best chemical treatment developed during testing prior to starting the actual pilot study runs required feeding alum, cationic polymer, and non-ionic polymer. The non-ionic polymer was used to strengthen the floc. The AQUARITROL® (see Section III. Methods and Equipment, for detailed information) was used to control the primary coagulant.

At the request of the Ministry of the Environment and Proctor and Redfern Engineering, a series of runs were conducted using only alum as the primary coagulant. Three runs feeding alum at set feed rates of 20, 30 and 40 mg/L were performed. Two of these runs were 8.5 hours in length and one of 16.5 hours was observed. In all three cases, however, filter breakthrough occurred at approximately 4 to 5 hours of run time, producing both high turbidity and aluminum residuals in the filter effluent. Clarifier removal of influent turbidity ranged from 33.9 to 70.0%. Filter effluent averaged between 0.24 to 0.33 NTU for these runs.

Two runs utilizing a alum substitute with the trade name Stern Pak were conducted. During one run only Stern Pak was fed and the other run was with alum, and a small amount of non-ionic polymer. The runs were 10.5 and 8.5 hours in length, respectively. Clarifier removal rates of influent turbidity ranged from 33.0 to 68.3%. Average effluent turbidity was 0.27 and 0.63 NTU. See Table 2 for details of chemical feeds.

Optimum treatment during the study was accomplished using a mixture of alum, a cationic polymer, Nalco 8105, and a small amount of Magnafloc 985N non-ionic polymer for floc strength. Filter run averaged 36.5 hours for runs 5, 6, 7 and 11, which used the previously described treatment. (Run 11 was terminated after 28 hours due to lack of time; however, it had a projected length of 41 hours. Effluent turbidities on all four of these runs averaged 0.098 NTU. Clarifier removal rates of influent turbidity consistently ranged from 62.2 to 69.3%. Color in the filter effluent was effectively removed to a level which averaged less than 5 color unit.

The pilot plant was operated at the normal design flow rates of 10 gpm and 5 gpm per square foot on the clarifier and filter respectively. The clarifier removed an average of 54% of the influent turbidity. Clarifier run lengths varied between 3 to 12 hour intervals during the runs. Pressure increase in the clarifier ranged from 0.7 psi to 1.7 psi (maximum allowable pressure increase is 1.7 psi).

III. METHODS AND EQUIPMENT

The pilot tests were conducted using the Microfloc trailer-mounted TRIDENT® Demonstration Plant. Technical data for the plant is listed in Table 1, and the flow schematic is shown in Figure 1. The demonstration unit is a small scale replica of a complete treatment system. The plant includes complete raw water chemical feed capabilities, is fully instrumented and has an integral clearwell to provide water for backwash of the filter.

As the influent from the pipeline entered the pilot plant, coagulation chemicals were injected in-line, prior to the water entering the Adsorption Clarifier™. The first stage Adsorption Clarifier™ consists of a packed bed of buoyant media which combines the mixing, contact flocculation, and solids removal functions. This system provides a well conditioned, clarified water to the second stage mixed media filter.

The TRIDENT® Demonstration Plant runs at a constant, but adjustable flow rate. Automatic flow control devices ensure constant flow throughout a run. Due to scale considerations, the clarifier is twice as large as is needed for flow to the filter. Half of the clarifier effluent is split off to waste and the other half passed through the mixed media filter. The filter effluent flow is monitored with a rotometer which is verified frequently by volumetric measurement. The clarifier and Trident filter are each equipped with a pressure gauge and recording device to monitor headloss development.

The Adsorption Clarifier™ flush or cleaning cycle can be initiated by any one of four means, or combination thereof:

1. Manual initiation by pushbutton.
2. Initiation by loss of head across the Adsorption Clarifier™ media. The differential pressure across the plastic media is sensed by a differential pressure switch. This pressure switch is normally set to be initiated at a pressure difference of 4 ft. of water.

TABLE 1

TRIDENT® DEMONSTRATION PLANT TECHNICAL DATA

I. Chemical Feed System

A. Number of Pumps/Tanks	6
B. Type Liquid Metronics; Positive displacement, variable stroke and speed	

II. Adsorption Clarifier

A. Plan Dimensions:	1'-5" x 1'-5"
B. Area, sq. ft.	2.0
C. Media Depth, in:	48
D. Media Type:	Ground Plastic

III. Filter Design

	MF162 Filter
A. Plan Dimensions:	1'-5" x 1'-5"
B. Area, sq. ft.:	2.0
C. Media Depth, in:	30
D. Media Configuration	
1. Anthracite Coal (1.2mm)	18
2. Silica Sand (0.6mm)	9 in.
3. High Density Sand (0.25mm)	3
E. Underdrain	Channel Rod
F. Surface Wash Type	Fixed Jet
G. Surface Wash Rate, gpm/sq.ft.	2.0

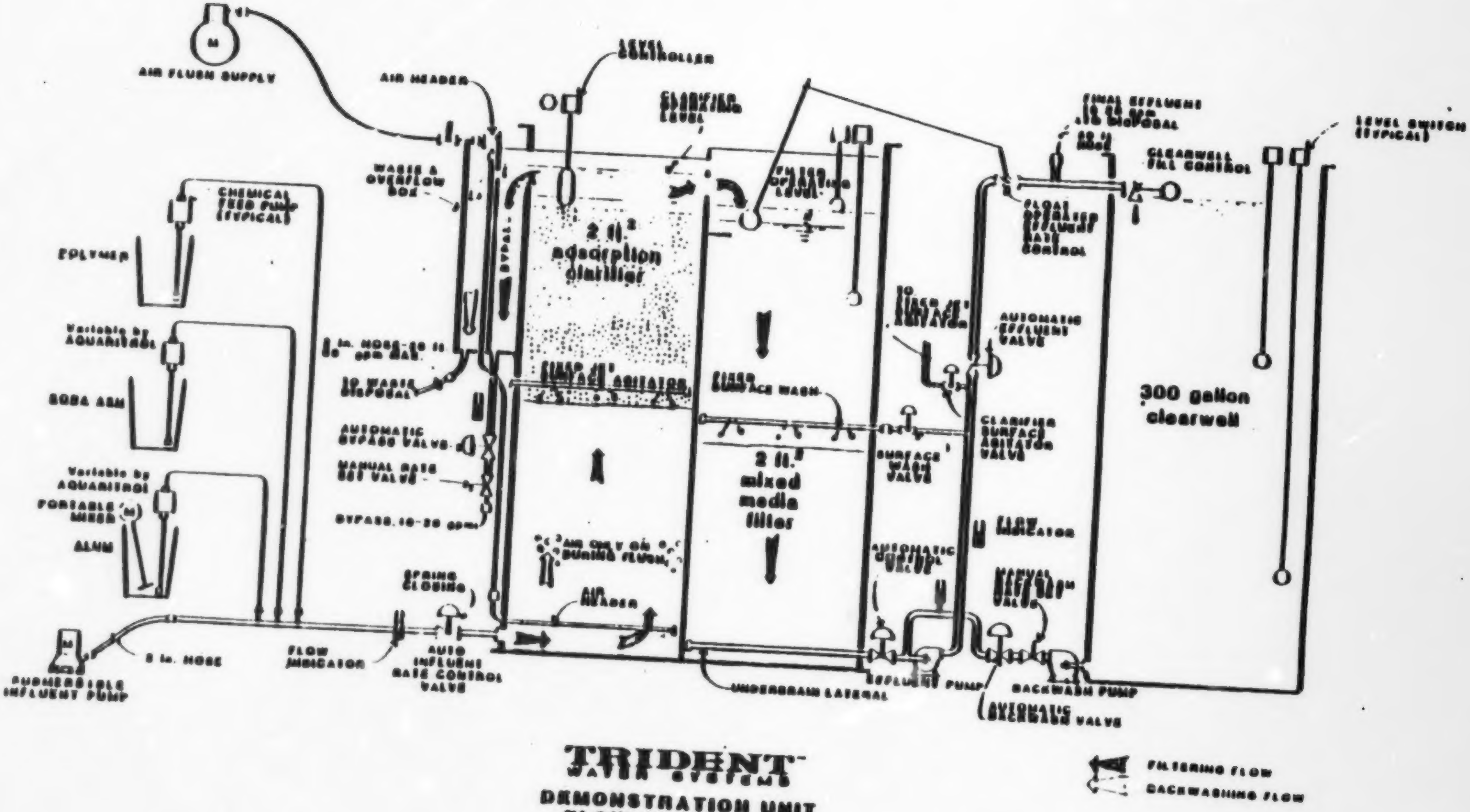
IV. Instrumentation

A. Controller Type: Programmable	General Electric
B. Influent/Effluent Turbidimeters:	Great Lakes Model 80
C. Coagulant Controller	AQUARITROL®
D. Data Logger	Metrosonic DL714

V. FLow Controls

TRIDENT® System

A. Influent - Griswold Flow Controller
B. Mixed Media Effluent - Keckley Float Valve
C. Bypass - Adjustable 60° V Notch Weir


AIR FLUSH SUPPLY
AIR HEADER
LEVEL CONTROLLER
CLARIFIER OPERATING LEVEL
FILTER OPERATING LEVEL
FINAL EFFLUENT 10-25 gpm TO DISPOSAL
20 ft. HOSE
CLEARWELL FILL CONTROL
LEVEL SWITCH (TYPICAL)
WASTE & OVERFLOW BOX
CHEMICAL FEED PUMP (TYPICAL)
POLYMER
Variable by AQUARITROL
SODA ASH
Variable by AQUARITROL
PORTABLE MIXER
ALUM
BYPASS
2 ft.³ adsorption clarifier
1½ in. HOSE-10 ft 10 gpm MAX.
TO WASTE DISPOSAL
FIXED JET SURFACE AGITATOR
AUTOMATIC BYPASS VALVE
MANUAL RATE SET VALVE
BYPASS, 10-20 gpm
AIR ONLY ON 0.C. DURING FLUSH
AIR HEADER
SPRING CLOSING
SUBMERSIBLE INFLUENT PUMP
2 in. HOSE
FLOW INDICATOR
AUTO INFLUENT RATE CONTROL VALVE
FIXED SURFACE WASH
2 ft.³ mixed media filter
UNDERDRAIN LATERAL
TO FIXED JET SURFACE AGITATOR
SURFACE WASH VALVE
AUTOMATIC CONTROL VALVE
EFFLUENT PUMP
FLOAT OPERATED EFFLUENT RATE CONTROL
AUTOMATIC EFFLUENT VALVE
CLARIFIER SURFACE AGITATOR VALVE
FLOW INDICATOR
MANUAL RATE SET VALVE
AUTOMATIC BACKWASH VALVE
BACKWASH PUMP
300 gallon clearwell
FILTERING FLOW
BACKWASHING FLOW

TRIDENT WATER SYSTEMS
DEMONSTRATION UNIT
FLOW SCHEMATIC

Figure 1

3. Initiation by time clock which will provide flushing at preset intervals. The time clock resets after the completion of each flush.

4. Initiation by the mixed media filter backwash cycle.

Cleaning of the Adsorption Clarifier™ is accomplished in a multiple step process:

1. The influent to the clarifier is shut off.

2. The clarifier media is fluidized by injecting air into the bottom of the clarifier chamber.

3. After the media is totally fluidized (about 60 seconds), the influent flow is restarted. The influent water flushes solids upward and out through a waste trough. This portion of the flush cycle normally lasts 2 minutes.

4. The flow of air to the clarifier is stopped. The flow of water through the clarifier to waste is continued for an additional 3 minutes. Upon completion of the flush cycle, the flow from the clarifier is diverted from waste back to the mixed media filter.

Air for the flushing process is provided by a small compressor.

The Mixed Media filter is backwashed with treated water at a rate of approximately 15 gpm/sq. ft. for a total of 6 minutes. Supplemental surface agitation is provided with a fixed surface wash device. A backwash cycle is initiated either manually or automatically by a high headloss condition as sensed by a vacuum switch set at 8 ft. headloss.

The pressure within the Adsorption Clarifier™ and headloss across the filter, effluent turbidity, clarifier effluent turbidity and the chemical feed rates are all continuously recorded using a six channel recorder. Manual readings are taken and recorded to provide a back-up for the electronic recording system and to insure all the data collected is accurate. Additional parameters are recorded during the runs and include apparent color, pH, alkalinity, and water temperature.

AQUARITROL® is a microprocessor-based system which receives an influent turbidity signal and optimizes chemical feed rates. It is a feedforward-feedback system with milli-second response time and solid state assembly.

Effluent turbidity is compared to the plant setpoint (for example 0.1 NTU) and primary coagulant dosages are adjusted based on the deviations observed. If the actual effluent turbidity is 5% higher than the setpoint, the coagulant dosage is appropriately increased. If the deviation were greater, for example 15%, a greater increase in coagulant dosage would be made. If the water quality is better than required, dosages (and chemical consumption) are reduced.

At the start of a run, the unit is initialized to the desired effluent and operational parameters. Turbidity setpoint, process timelag, baseline rate of dosage change, and dead band range are entered at the unit keyboard.

A process timelag equivalent to the operating system detention time is programmed into AQUARITROL®. Under normal raw water conditions, AQUARITROL® will be acting a full lagtime after changes in coagulation conditions occur. During periods when raw water conditions are abnormal, the AQUARITROL® will act more frequently and initiate greater dosage changes. Microfloc Products is convinced that no plant operator can act soon or as effectively as AQUARITROL®.

AQUARITROL® is a completely self-contained solid state control panel which measures 16" x 20". 11 functions are initiated by two field replaceable circuit boards. Should maintenance be required, additional circuit boards are available on a 24 hour basis from Microfloc Products.

AQUARITROL® can accept flow signals or pH levels, and adjust chemical dosages of coagulant and pH control chemicals accordingly.

IV. RESULTS AND DISCUSSIONS

A. Study Scope

Determination of treatment scheme required to effectively produce a high quality effluent is best done onsite using trial runs and jar tests. The trial runs were done using the complete TRIDENT® system to determine optimum chemicals, dosage requirements, and chemical combinations needed to successfully treat water at the Kirkland Lake site. For some of the runs the chemical dosage was directed by the Ontario Ministry of the Environment for the purpose of comparing data with another pilot unit that was also conducting tests concurrently with the TRIDENT®.

The treatment scheme developed for optimum treatment required a combination of treatment chemicals, which included alum, cationic polymer (Nalco 8105), and small amounts of non-ionic polymer (Magnefloc 985N).

Alum was used as a primary coagulant in all runs but limited success in treatment was achieved when just alum alone was fed.

The primary goal during runs was the automatic production of water with a turbidity below 0.25 NTU and color below 5 units. Chemical dosage requirements are summarized in Table 2. Results from the runs are summarized in Table 3.

TABLE 2

CHEMICAL FEED RATES
MG/L

POLYMERS

	Alum	Nalco 8105	Magnefloc 985N	Stern Pak
Run #1	21.3	0.0	.09	
Run #2	45	--	--	
Run #3	30	--	--	
Run #4	20.5	13*	.05	
Run #5	7.42	4.9	.05	
Run #6	8.7	2.9	.05	
Run #7	8.0	2.6	.05	
Run #8	20	--	--	
Run #9	10.5	--	.05	17.5
Run #10				25.3
Run #11	7.6	4.9	.05	

* Fed for a portion of the run.

B. Details of the Runs

Run #1

The chemicals fed for run #1 were alum and non-ionic (Magnafloc 985N). Effluent turbidity for the first 7 hours of the run averaged below 0.05 NTU. After seven hours of run time the turbidity breakthrough of the filter was observed. At 11.5 hours and 6.8 feet of headloss into the run the filter was manually backwashed. The average effluent turbidity for the run was 0.33 NTU, which was caused by continuation of the filter run after breakthrough had occurred. The clarifier averaged a removal rate of 57.1% of influent turbidity. The clarifier was set to flush automatically every six hours of run time, or at reaching 1.7 psi pressure within the A.C. clarifier. Flushes during this run occurred after 4 to 5 hours of clarifier operation. Residual aluminum and iron concentrations were monitored for most runs. The results are listed in Table #3.

Run #2

The Ontario Ministry of the Environment requested a series of runs feeding alum as the only coagulant. This first alum only run had a steady feed of 45 mg/L alum, therefore, the AQUARITROL* coagulant control system was not used during this run.

The effluent turbidity once again was very good for the first few hours of the run. Average effluent turbidities until 4.5 hours into the run were well below 0.1 NTU. (The on-line effluent turbidimeter was fogging during the first hour of this run which accounts for higher readings compared to our manually taken samples during this period.) The combination of cold water and heavy alum dose seemed to be the cause of short time between clarifier flushes (3 to 4 hours) and the filter breakthrough approximately 6 hours into the run.

Run #3

This run is similar to the previous run with the only difference being the alum dose was reduced to 30 mg/L and held constant for the run.

The results were also similar. The lower alum dosage resulted in about a 2 hour longer filter run before turbidity broke through. The clarifier run cycle was also longer before requiring a flush (5.5 hours). Filter breakthrough occurred at about 8.5 hours into the run; however, the run as continued for an additional 14 hours. This resulted in a high average effluent turbidity for the run of 0.33 NTU.

Run #4

Another alum only run was started using the AQUARITROL* unit to determine the optimum alum dose. The unit stabilized the alum feed at 26 mg/L. Once again the effluent quality was very good for the first four hours of treatment, but as the filter approached 4 feet of headloss the effluent turbidity started to climb. Instead of allowing the filter to breakthrough, the operator started to feed a cationic polymer that had been successful in jar tests in addition to alum already being fed. Within 20 minutes of introducing the polymer the effluent turbidity dropped from 0.12 NTU to 0.06 NTU. The AQUARITROL* unit gradually cut the alum dose to 5.5 mg/L, the polymer, Nalco 8105, was being fed continuously at 13 mg/L. The run continued at a low turbidity (below 0.10 NTU) for the next 8 hours until the filter began to breakthrough at 7.2 feet of filter headloss. The average effluent turbidity for the run as 0.12 NTU.

Run #5

Based on positive results from the previous run, alum, Nalco 8105 cationic, and a small amount of Magnefloc 985N were used for this run. The alum was fed at a continuous 8.0 mg/L feed rate and the 8105 feed was controlled by the AQUARITROL* unit, starting at 9.0 mg/L. At eight hours into the run the AQUARITROL* unit had stabilized the 8105 feed rate at 4.0 mg/L. 3.5 mg/L to 4.0 mg/L was the average feed rate after this point in the run. At 08:00 January 22, a comparison of the turbidity readings obtained manually and the continuous flowthrough turbidimeter was made. This comparison revealed a slight difference in the turbidity readings (0.09 vs. 0.13NTU). Investigation to determine the cause of this difference found the flowthrough turbidimeter cell had fogged during the night. Even including the false high readings, the overall effluent turbidity average was 0.12 NTU. The clarifier removed 54% of the turbidity it was receiving on the influent, and clarifier flushes occurred at 7 to 8 hour intervals after the first flush at 4.5 hours into the run (for demonstration). Run #5 had a total time of 31.6 hours before it was terminated automatically at 8 feet of headloss. There were no signs of turbidity breakthrough of the filter before this headloss was reached. Aluminum residuals on the effluent were below 0.05 mg/L when sampled just prior to backwash.

Run #6

Based on information from the preious run and jar tests, it appeared that 3.0 mg/L of cationic polymer, 0.05 mg/L of non-ionic polymer (Magnefloc 985N) was the optimum polymer combination. Therefore to optimize overall chemical dosages the AQUARITROL* was allowed to determine the alum. This resulted in a filter run length of 42.5 hours at an average alum dose of 8.7 mg/L.

Clarifier performance improved this run, removing an average of 69.3% of the incoming turbidity. Clarifier flusnes were controlled by a timer to occur every 12 hours.

Filter breakthrough was not a problem as effluent turbidity was reading below 0.09 NTU at 42.5 hours into the run, and 8.1 feet of headloss across the filter. Average effluent turbidity was 0.08 NTU for the run.

Run #7

The chemicals used in this run are the same as the previous one. The cationic Polymer (8105N Nalco) dose was lowered slightly at the beginning of the run (2.0 mg/L), but later returned to 3.5 mg/L to 4.0 mg/L. This dosage seems to produce maximum effluent quality. Average effluent turbidity during this 30 hour run was 0.09 NTU. Clarifier performance was similar to run #6 with an average 62.2% removal of influent turbidity with 12 hours between clarifier flushes.

Run #8

This run was the last of the series of runs directed by the Ministry of the Environment. The only chemical fed for the duration of this run was alum at 20 mg/L. The run terminated at 8.0 feet of headloss after 13 hours. Average filter effluent turbidity was 0.29 NTU. The clarifier removed 33.9% of the influent turbidity.

Run #9

Proctor & Redfern Engineering requested a run using a cationic polymer with the trade name "Stern Pak". Alum was fed at 10.5 mg/L, Magnefloc 985N as 0.05 mg/L and Stern Pak at 17.5 mg/L. The first 4 hours of the run appeared promising, as the effluent turbidity averaged 0.10 NTU during this period.
The next 4.5 hours of run time saw a quick increase of filter headloss and breakthrough.

Run #10

This run utilized Stern Pak cationic polymer as the only coagulant and only chemical added. The AQUARITROL® unit controlled the chemical dosage and maintained it at an average of 26 mg/L. The filter had a quick and steady headloss increase throughout this run of 11 hours. The clarifier removed 33% of the influent turbidity. Average effluent turbidity was 0.27 NTU.

Run #11

This was the last run of the pilot study. It was a return to the chemicals that had proved to work best. Alum feed averaged 7.6 mg/L, Nalco 8105 cationic at 4.9 mg/L and Magnefloc 985N was fed at 0.05 mg/L until the last 6 hours of the run at this time the 985N feed was stopped to determine its importance in plant performance. No change in effluent quality was observed over the following hours of test. The non-ionic polymer (985N) appears to be an optional addition to the chemical feed scheme.

Due to lack of time, the run was terminated at 6.0 feet of headloss at 28 hours of run time. Estimated run length to reach 8 feet of headloss is approximately 41 hours of filtering time.

Average filter effluent turbidity was excellent at 0.10 NTU. Clarifier removal of influent turbidity averaged 63.5% with 12 hours between flushes.

C. Color Removal

The color of the raw water was low and averaged 13 color units for the duration of the study. The degree of success in removing the color was dependent on the chemical treatment scheme used during the run. Good color removal was obtained using alum alone and the chemical treatment scheme which required feeding non-ionic and cationic polymers. The Stern Pak, treatment was not as effective in removing color as the two treatment schemes previously mentioned.

D. Net Water Production

Net water production is defined as the fraction of rated filtered water flow available for use. The net production for runs #5, #6, #7 and #11 during which chemical treatment appeared to be optimized resulted in an average net production of 97.1% for the four runs. The volume of backwash water and volume of flush water averaged 1.4 and 1.54 percent of net production, respectively, for the runs listed above.

TABLE 4

	Run Length	Clarifier Run Hrs	Net Production	Vol. of Backwash H_2O as % of Net Production	Vol. of Flush H_2O as % of Net Production
Run #1	11.8	4.25	93.8%	4.2%	2%
Run #2	8.0	3.0	87.4%	6.4%	6.2%
Run #3	16.25	5.75	94.1%	3.4%	2.5%
Run #4	16.5	5.0	92.7%	3.4%	3.9%
Run #5	31.6	12	96.7%	1.6%	1.7%
Run #6	42.2	12	97.5%	1.2%	1.3%
Run #7	31	12	96.9%	1.5%	1.65%
Run #8	8.5	4	90.2%	6.4%	3.4%
Run #9	8.0	5	90.4%	6.4%	3.2%
Run #10	10.5	10.5	93.6%	5.1%	1.3%
Run #11	28	12	97.2%	1.3%	1.5%

KIRKLAND LAKE, ONTARIO

TABLE 3 SUMMARY OF RESULTS

	FILTER RUN TIME (HOURS)	RAW NTU	CLRFER INFLNT NTU	CLRFER EFFLNT NTU	CLRFER PERCENT REMOVAL	FILTER EFFLT NTU	pH FIELD MEASUREMENT		COLOR		ALKALINITY		TEMP (F)	IRON		MANGANSE		ALUMINUM	
							RAW	EFFLNT	RAW	EFFLNT	RAW	EFFLNT		RAW mg/L	EFFLNT mg/L	RAW mg/L	EFFLNT mg/L	RAW mg/L	EFFLNT mg/L
RUN 1	11.0	0.27	3.5	1.5	57.1	0.33	6.72	6.53	13		42	29.7	32.5	0.2	0.1	ND	ND	NA	NA
RUN 2	8.5	0.27	4.24	1.27	70.0	0.24	6.78	6.26	13		42	22.4	32.9	0.3	0.2	ND	ND	NA	0.02
RUN 3	16.25	0.29	2.62	1.56	40.5	0.33	6.95	6.44	13		43	30	33	NA	NA	ND	ND	NA	0.05
RUN 4	15	0.29	2.55	1.34	47.5	0.12	6.7	6.9	13	3	44	30	33.2	NA	NA	ND	ND	NA	0.025
RUN 5	31.6	[illegible]	2.1	0.96	54.3	0.12	6.7	6.5	13	2	45	34	33.4	0.3	0.2	ND	ND	NA	0.026
RUN 6	[illegible]	[illegible]	[illegible]	1.01	65.3	0.08	6.8	6.5	13	2.5	45	37	33.6	0.3	<.	ND	ND	NA	0.02
RUN 7	31	0.28	2.38	0.9	62.2	0.09	6.8	6.6	13	2	47	39	34.2	0.3	<.	ND	ND	NA	0.04
RUN 8	8.5	0.28	2.71	1.79	33.9	0.29	6.8	6.7	13	4	37	23	34.3	NA	NA	ND	ND	NA	0.08
RUN 9	8.5	0.23	2.4	0.76	68.3	0.27	6.8	6.6	16	<	39	23	35.8	0.3	NA	ND	ND	NA	0.015
RUN 10	10	0.34	0.88	0.59	33.0	0.16	6.8	6.7	14	5	37	32	36.4	0.3	0.2	ND	ND	NA	0.25
RUN 11	*	0.31	2.64	0.963	63.5	0.10	6.8	6.63	14	2.6	28.8	24.3	33.8	0.3	0.15	ND	ND	NA	0.02

* THIS RUN TERMINATED AT A HEADLOSS 6.0 FEET OF WATER. PROJECTED RUN LENGTH WOULD BE 41 HOURS.

LOCATION Kirtian [illegible] RUN NO. 1 DATES: 1/16/8[illegible] CLARIFIER RATE 10 gpm/sq.ft. FILTER RATE 5 gpm/sq.ft.
EQUIPMENT TP [illegible]

CLARIFIER FLUSH DURATION TIMERS
AIR(MIN) 1 AIR+WATER(MIN) 3
UTF WASH (MIN) 4 TIME BTWN FLUSH(HRS) 6 Set

FILTER BACKWASH
MINUTES 7
GPM 32

TTL RUN LGTH (HRS) 11.5

DATA LOGGER Time on 11:11
Recorder on 11:11

TIME	ELAP TIME HOURS	TURBIDITY, NTU RAW	CLAR INF	CLAR EFF	FILT EFF	HEADLOSS, FT CLAR	FILT	AQUARITROL TURB SET PT	CHEM FEEDS	READ BAND	TEMP RAW F°	pH RAW	pH EFF	COLOR RAW	COLOR EFF	ALK RAW	ALK EFF	CHEMICAL FEED MG/L ALUM	POLYMER 985N	
11:11	0	[illegible]	[illegible]	0.95	0.06	0.55	1.9	0.10	36.7	0.03	31.6	6.7	6.6	18	.5					Bergquist
1300	2	0.24	3.7	2.0	0.04	1.3	2.3	0.10	31.2	0.03	31.5	6.7	6.6	13	<5				0.13	Aluminum 0.02 & color [illegible]
1400	3	0.21	4.4	1.8	0.04	1.5	2.8	0.10	24.5	0.03	32.5	6.7	6.5	13	<5		27.3			Pick up Effluent sample [illegible]
1550	4.5	[illegible]	[illegible]	0.97	0.05	0.5	3.5	0.09	27.3	0.03	32.6	6.1	6.6	13	<5	42		21.3	0.07	Set 985N [illegible]
[illegible]	6.0	[illegible]	2.5	1.60	0.04	0.9	4.3	0.08	27.3	0.03	32.4		6.5	10	<5					Alum at 24.1% [illegible] 21.3 mg/l
1800	7.0	0.21	2.9	1.8	0.08	1.1	4.4	0.06	27.3	0.03	33.[illegible]	6.8	6.0	13	<5	42	32	21.3	0.07	
[illegible]	BALLOON			at	[illegible]															985 N [illegible] Polymer
			[illegible]	1							[illegible]	[illegible]	[illegible]	[illegible]		42	465	.113	.079	

LOCATION Kirkland Lk Out RUN NO. 2a DATES: 1/17/87 CLARIFIER RATE 10 gpm/sq.ft. FILTER RATE 5 gpm/sq.ft.

EQUIPMENT Trident Tri.

CLARIFIER FLUSH DURATION TIMER
AIR(MIN) 1 AIR+WATER(MIN) 3
WTR WASH (MIN) 4 TIME BTWN FLUSH(HRS) 6 set

FILTER BACKWASH
MINUTES 10.5
GPM 28

TTL RUN LGTH (HRS) 8.0

1358 Start Run
Log + Chart

TIME	ELAP TIME HOURS	TURBIDITY, NTU RAW	TURBIDITY, NTU CLAR INF	TURBIDITY, NTU CLAR EFF	TURBIDITY, NTU FILT EFF	HEADLOSS, FT CLAR	HEADLOSS, FT FILT	AQUAMITROL TURB SET PT	AQUAMITROL CHEM FEED	AQUAMITROL DEAD BAND	TEMP RAW	pH RAW	pH EFF	COLOR RAW	COLOR EFF	ALK RAW	ALK EFF	CHEMICAL FEED MG/L ALUM	CHEMICAL FEED MG/L POLYMER	
1400	0	0.19			0.08	0.5	2.0													
1500	1	0.26	4.2	1.30	0.06	0.8	2.2		42.9		32.4	6.8	6.3					45	0	
1600	2	0.22	3.4	0.92	0.06	1.0	2.4		42.9		32.4	6.8	6.3	13	< 5	48	28.5	45	0	Regional lab sample [illegible] - (0-hrs) 0.03 [illegible] 0.13 [illegible]
1700	3	0.26	4.6	0.98	0.07	1.3	2.6		42.9		33.5	6.8	6.3					45	0	
1850	4.5	0.27	4.7	1.60	0.06	1.0	3.6		42.9		33.6	6.8	6.3	13	< 5	4[illegible]	20.4	45	6	
2200	8.0	0.29	4.4	1.35	0.58	0.8	5.4		42.9			6.7	6.2	13	< 5	41.0	20.5	46	0	Amount Aluminum Residual Filtrate 0.02 m
		.21	[illegible]	1.11	.15				42.9		32.8	6.8	6.3	13	< 5	41	20	45	0	versus alum in [illegible] mg/l
2225	Filt.		backwash		due	to	filter		breakthrough		32.9	6.78	6.26			12.25	12.25	15.17	—	Filter breakthrough at 1980 NAS @ 4.0 Cr N.L.

ENG/9/22/86

LOCATION Kirkland LK ONT RUN NO. 3 DATES: 1/19/87 CLARIFIER RATE 10 gpm/sq.ft. FILTER RATE 5 gpm/sq.ft.
EQUIPMENT TRIDENT TCL

CLARIFIER FLUSH DURATION TIMERS
AIR(MIN) 1 AIR+WATER(MIN) 3.5
STD WASH (MIN) 4 TIME BTWN FLUSH(HRS) 6

FILTER BACKWASH
MINUTES 11
GPM 28

TTL RUN LGTH (HRS) ____

TIME	ELAP TIME HOURS	TURBIDITY, NTU				HEADLOSS, FT		AQUARITROL						COLOR				CHEMICAL FEED MG/L		
		RAW	CLAR INF	CLAR EFF	FILT EFF	CLAR	FILT	TURB SET PT	CHEM FEEDS	DEAD BAND	TEMP RAW	pH RAW	pH EFF	RAW	EFF	ALK RAW	ALK EFF	ALUM	POLYMER	
1050	0	0.33	2.5	0.9	0.30	0.45	2.1	—	30.8	—	32.5	6.7	6.4	12	<5	44.5	32	30	0	
1150	1	0.35	2.8	1.2	0.11	0.60	2.4	—	30.8		32.5	6.7	6.4	12	<5	44.5	30	30	0	
1250	2	0.38	2.4		0.10	0.80	2.7		30.8		33.0			12	<5			30	0	Logged on 10:31 am
1350	3	0.26	3.0	2.3	0.09	1.0	2.9		30.8		34.0	6.8	6.4	12	<5	44	30	30	0	
1450	4	0.28	2.9	2.5	0.09	1.1	3.2		30.8		33.6	6.8	6.5	12	<5			30	0	
1550	5	0.30	2.5	3.5	0.09	1.3	4.0		30.8		33.0	6.7	6.4	12	<5	44	30	30	0	Aluminum 0.05 mg/l resid.
1650	6	0.34	2.7	1.4	0.12	0.4	4.4		30.8		33	6.8	6.5	12	<5			30	0	calibrated effluent turb to 0.09
1750	7	0.38	2.7	1.2	0.09	0.7	4.8		30.8		33	6.8	6.5	12	<5	40	28	30	0	
2200	11.5	0.34	2.1	1.0	1.25	1.5	6.4		30.8		32.8	6.7	6.4	12	<5			30	0	Filter breakthrough at 1825 –
		.15	~.62	1.54	.25						33.0	6.75	6.4	12		43.1	30	30	—	will continue run until 8 ft of
1345	Filter backwash at 8 ft long after filter breakthrough																			headloss
																				Breakthrough at 8 ft HL.

RMG/9/22/86

LOCATION [illegible]   RUN NO. 4   DATES: 1/20   CLARIFIER RATE 10 gpm/sq.ft.   FILTER RATE 5 gpm/sq.ft.
EQUIPMENT [illegible]

CLARIFIER FLUSH DURATION TIMERS
AIR(MIN) 1   AIR+WATER(MIN) [illegible]
WTR WASH (MIN) 5   TIME BTWN FLUSH(HRS) 6

FILTER BACKWASH
MINUTES [illegible]
GPM [illegible]

TTL RUN LGTH (HRS) 17

TIME	ELAP TIME HOURS	TURBIDITY, NTU RAW				HEADLOSS, FT CLAR		AQUARITROL TURB SET PT			TEMP RAW	pH RAW	pH EFF	COLOR RAW		ALK RAW	ALK EFF	CHEMICAL FEED MG/L ALUM	
		RAW	CLAR INF	CLAR EFF	FILT EFF	CLAR	FILT	TURB SET PT	CHEM FEEDS	DEAD BAND	TEMP RAW	pH RAW	pH EFF	RAW	EFF	ALK RAW	ALK EFF	ALUM	POLYMER
1000	0	0.28		[illegible].9	0.10	0.1	2.1	0.10	36.1	0.01	33	6.8	6.8	19	2	44	26		0
1100	1		2.8	1.2	0.08	0.8	2.3	0.10	41.5	0.04	33	6.7	6.4	13	3				
1200	2	0.29	2.9	1.9	0.08	1.0	2.7	0.10	37.5	0.04	33	6.7	6.7	13	2	44	30	32	0
1400	4	0.26	2.7	2.7	0.10	1.5	3.3	0.10	31.2	0.01	33	6.7	6.4	13	3				
1500	5	0.27	2.6	1.6	0.11	0.4	4.0	0.12	31.2	0.04	33.5	6.7	6.4	13	3			26	0
1600	6	0.23	2.7	1.4	0.11	0.6	4.2	0.12	31.2	[illegible]	[illegible]	6.7	6.4	13	3	44	32	26	0
1700	7	0.29		0.9	0.06	0.8	4.7	0.12	28.1	0.01	33.8	6.7	6.3					13	13
[illegible]		0.20	1.[illegible]	0.62	0.01	.1	5.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6.6	6.5	13	0			5.5	13/0.5
2150	11.6	0.23		0.77	0.10	0.4	5.8	0.08	14.5	0.04				13	0				
0300	[illegible]		1.[illegible]																
		.21	2.55	1.54							33.3	6.7	6.4	[illegible]	3	4[illegible]	29.3	25.5	13/6.5

AMANDA 0.025 mg/l [illegible]

clear [illegible] [illegible] 17 [illegible]

2045 Plant flush due to shut down

[illegible] [illegible] [illegible] [illegible]

[illegible] 17 [illegible]

EMG/9/22/86

LOCATION [illegible]
EQUIPMENT [illegible]

RUN NO. ___

DATES: [illegible] CLARIFIER RATE 12 gpm/sq.ft. FILTER RATE 5 gpm/sq.ft.

CLARIFIER FLUSH DURATION TIMERS

AIR(MIN) 1 AIR+WATER(MIN) 4
WTR WASH (MIN) 5 TIME BTWN FLUSH(HRS) 6.00 [illegible]

FILTER BACKWASH
MINUTES 27 5
GPM 11.5

TTL RUN LGTH (HRS) 30

TIME	ELAP TIME HOURS	TURBIDITY, NTU				HEADLOSS, FT		AQUARITROL						COLOR				CHEMICAL FEED MG/L		
		RAW	CLAR INF	CLAR EFF	FILT EFF	CLAR	FILT	TURB SET PT	CHEM FEEDS	BEAD BAND	TEMP RAW	pH RAW	pH EFF	RAW	EFF	ALK RAW	ALK EFF	ALUM	POLYMER	
[illegible]																				
												6.8		12		11	[illegible]			
												6			2			9.0	9.0 / 0.05	
[illegible]																				
[illegible]															2					
[illegible]																46	30	8.0	60 / 0.05	[illegible] Calcium [illegible]
[illegible]														12	[illegible]					
6 [illegible]															2	46	[illegible]			
175 [illegible]																				
19[illegible]															2	45	[illegible]		[illegible]	
[illegible]														7	1					
[illegible]			1.7	1.[illegible]												117	31			
[illegible]			1.4										6.5					1.0	4.0 / 0.05	
[illegible]																				
[illegible]			1.9				6.1						6.5	12	2	44.5	37			
1300	27.5	0.19	2	0.18	0.06	0.3	7.1	0.10	1.8	0.04	33.4	6.7	6.5	12	2	44.5	37	7.5	38 / 0.05	
1400	28.5	0.22	2	1.7	0.08	0.9	7.4	0.10	1.8	0.04	33.5	6.6	6.5	12	2			7.5	4.0 / 0.05	
1540	10	[illegible]																		
		.181	2.11	.96							33.4	6.71	6.19	12.48	2.33	45.43	31.3	1.42	4.5 / .05	1540

EWG/9/22/86

LOCATION Kirtland, NM RUN NO. 6 DATES: 1/21/87 / 1/23/87 / [illegible] CLARIFIER RATE 10 gpm/sq.ft. FILTER RATE 5 gpm/sq.ft.
EQUIPMENT [illegible]

CLARIFIER FLUSH DURATION TIMERS
AIR(MIN) 1 AIR+WATER(MIN) 3
WTR WASH (MIN) 5 TIME BTWN FLUSH(HRS) 12

FILTER BACKWASH
MINUTES 17
GPM 11

TTL RUN LGTH (HRS) 42

TIME	ELAP TIME HOURS	TURBIDITY, NTU RAW	CLAR INF	CLAR EFF	FILT EFF	HEADLOSS, FT CLAR	FILT	AQUARITROL TURB SET PT	CHEM FEEDS	READ RANG	TEMP RAW	pH RAW	pH EFF	COLOR RAW	COLOR EFF	ALK RAW	ALK EFF	CHEMICAL FEED MG/L ALUM	POLYMER 8105/TIC4	
1620	0	0.20	3.4	1.0	0.13	0.4	2.1	0.10	9.8	0.04	33.6	6.8	6.5	13	3	42	36	12	2.0 / 0.01	
1800	1.5	0.26	3.8	1.2	0.12	0.5	2.2	0.10	21.6	0.04	33.2	6.8	6.6	13	3	44	36			
1900	2.5	0.28	3.6	1.1	0.11	0.6	2.6	0.10	26.9	0.04	33.0	6.8	6.6	12	3	46	38	16	3.5 / 0.05	Switch over TO AQuatrol [illegible]
2100		0.21	2.3	0.96	0.09	0.7	2.8	0.10	16.9	0.04	33.6	6.8	6.5	12	3	44	38	10	3.0 / 0.05	Raise 8105 dose to [illegible]
850	16	0.20	4.1	1.0	0.08	0.4	4.2	0.10	10.5	0.04	33.4	6.7	6.5	12	2	44	36	8	8.0 / 0.01	immediate drop [illegible]
950	17	0.26	3.7	1.1	0.06	0.5	4.4	0.10	9.8	0.04		6.7	6.5	12	2	44	34	7		950 reading [illegible]
1050	18	0.21	3.5	1.0	0.06	0.5	4.4	0.10	7.8	0.04		6.7	6.5	12	3			7		
1250	20	0.26	3.4	1.0	0.07		6	0.10	9.8	0.04	[illegible]	6.7	6.6	13	3			7		0.0[illegible] Al
1350	21	0.18	3.2	0.95	0	0.7	4.7	0.10	9.8	0.04	32.9	6.7	6.4	13	3					[illegible]
1450	22	0.26	2.9	1.1	0.06	0.7	4.8	0.10	9.8	0.04	32.5	6.7	6.5	13	3	46	38	7	3.0 / 0.05	
1550	23	0.26	[illegible]	1.0	[illegible]	0.8	5.0	0.10	9.8	0.04	32.5	6.8	6.6	13	2			7	3.0 / 0.05	
1650	24	0.30	2.9	1.1	0.01	0.4	5.2	0.10	9.8	0.04	[illegible]	6.7	6.6	13	2					
1750	25	[illegible]	3.2	0.97	0.01	0.4	5.4	0.10	9.8	0.04	[illegible]	6.8	6.6	13	2	46	38	7.5	8.0 / 0.05	
[illegible]		0.29	3.0	1.00	0.01	0.8	6.0	0.10	9.8	0.04	32.2	6.8	6.6	13	2					0. [illegible]
[illegible]	[illegible]	0.30	3.2	0.93	0.08	0.5	7.5	0.10	9.8	0.04	32.3	6.8	6.6	13	2					
[illegible]	[illegible]	0.29	3.4	[illegible]	0.08	0.6	7.7	0.10	9.8	0.04	32.5	6.7	6.5	13	2	46	38	7.8	3.0 / 0.05	
[illegible]	[illegible]	[illegible]	3.[illegible]	[illegible]	[illegible]		1.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	32.65	[illegible]	6.54	13.0	[illegible]	44.5	37	6.8	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]																

ENG/9/22/86

LOCATION Kirkland Lk Out RUN NO. 7 DATES: 1/[illegible]6 CLARIFIER RATE 13 gpm/sq.ft. FILTER RATE 5 gpm/sq.ft.
EQUIPMENT [illegible]
US GALLONS

CLARIFIER FLUSH DURATION TIMERS
AIR(MIN) 1 AIR+WATER(MIN) 4
WTR WASH (MIN) 5 TIME BTW[illegible] FLUSH(HRS) 12

FILTER BACKWASH
MINUTES 11
GPM 27

TTL RUN LGTH (HRS) 31

TIME	ELAP TIME HOURS	TURBIDITY, NTU RAW	TURBIDITY, NTU CLAR INF	TURBIDITY, NTU CLAR EFF	TURBIDITY, NTU FILT EFF	HEADLOSS, FT CLAR	HEADLOSS, FT FILT	AQUARITROL TURB SET PT	AQUARITROL CHEM FEEDS	AQUARITROL DEAD BAND	TEMP RAW	pH RAW	pH EFF	COLOR RAW	COLOR EFF	ALK RAW	ALK EFF	CHEMICAL FEED MG/L ALUM	CHEMICAL FEED MG/L POLYMER 8101 / 7105	
[illegible]	[illegible]	0.28	[illegible]	3.97	0.10	0.4	2.2	0.10	26.5	0.04	34.2	6.8	6.5	13	3	48	36	10	3.8 / 0.05	[illegible] 1609- [illegible] 1608 Run Start
1100	1.0		[illegible]	1.2	[illegible]															
2100	5.0	[illegible]	[illegible]	1.1	[illegible]	0.8	2.6	0.10	16.0	0.04	33.7	6.8	6.6	13	2			6	2.0 / 0.05	
900	17	0.27	4.0	1.5	0.11	[illegible]	5.5	0.10	34.7	0.04	34.0					44		16	2.0 / 0.05	aquastrol [illegible] dose to 16 [illegible]
1000	18	[illegible]	[illegible]	[illegible]	0.09	0.9	6.0	0.10	[illegible]	[illegible]	[illegible]	6.7	6.5	13	2					alum)
[illegible]	[illegible]		[illegible]	[illegible]	0.09	1.0	6.3	0.10	[illegible]	[illegible]	[illegible]	6.8	6.6	13	2	48	40	5	3.8 / 0.05	[illegible]
1200	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6.7	[illegible]	2					Cl2 added at 0.6 mg/l
1400	[illegible]	[illegible]	1.9	0.98	[illegible]	1.1	6.8	0.10	13.7	0.04	34.6	6.8	6.7	15	2	48	38			1100 clean eff. [illegible]
1500	23	0.30	2.1	0.40	0.10	1.3	7.2	0.10	13.7	0.04	34.5	6.8	6.7	13	2					[illegible] calibrate eff [illegible] 0.07
1600	24	[illegible]	1.7	0.67	0.07	[illegible]	[illegible]	0.10	19.1	0.04	34.6	6.9	6.8	12	2				3.5 / [illegible]	recalibrate eff[illegible] [illegible] 0.08
1700	25	[illegible]	1.6	0.45	0.06	0.5	7.8	0.10	19.3	0.04	34.2	6.8	6.6	12	1			6.3	4.0 / 0.05	[illegible] 0.3 mg/l
1800	26	[illegible]	1.8	0.43	0.05	[illegible]	7.8	0.10	15.2	0.04	34.0	6.8	6.7	13	2	49	42			[illegible] 0.1 mg/l
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13	1			1.8	[illegible]	Cl at 1600 0.06 mg/l
[illegible]	[illegible]		[illegible]																	[illegible]
		[illegible]	[illegible]	[illegible]							34.2	6.8	6.63		1.91	47.2	39	8.02	[illegible] / .05	SAMPLE [illegible] 1/22/87
																				[illegible]
																				[illegible] 1750 0.02 mg/l [illegible]

ENG/9/22/86

LOCATION [illegible] RUN NO. 8 DATES: 1/29 CLARIFIER RATE 10 gpm/sq.ft. FILTER RATE 5 gpm/sq.ft.
EQUIPMENT [illegible]

CLARIFIER FLUSH DURATION TIMERS
AIR(MIN) 1 AIR+WATER(MIN) 4
WTR WASH (MIN) 4 TIME BTWN FLUSH(HRS) 12

FILTER BACKWASH
MINUTES 27
GPM 11
TTL RUN LGTH (HRS) 8.0

	ELAP TIME	TURBIDITY, NTU				HEADLOSS, FT		AQUARITROL						COLOR				CHEMICAL FEED MG/L		
TIME	HOURS	RAW	CLAR INF	CLAR EFF	FILT EFF	CLAR	FILT	TURB SET PT	CHEM FEED%	DEAD BAND	TEMP RAW	pH RAW	pH EFF	RAW	EFF	ALK RAW	ALK EFF	ALUM	POLYMER	
[illegible]	4	[illegible]	2.6	1.1	0.59	0.4	2.1	0	21.5	0	34	6.8	6.7	13	7	48	40	20	0	Alum [illegible]
[illegible]	1.0	[illegible]	2.4	0.15	0.28	0.5	2.3	0	[illegible]	0	34.2	6.8	6.7	13	4	46	38	20	0	
[illegible]	[illegible]	0.42	[illegible]	1.3	0.19	0.7	2.6	0	[illegible]	0	34.1	6.8	6.7	13	4			20	0	
[illegible]	[illegible]	[illegible]	3.1	1.9	0.16	0.8	2.7	0	[illegible]	0	34.2	6.8	6.7	13	4	37.3	30	20	–	
1750	[illegible]	0.31	3.0	2.3	0.14	0.9	3.0	0	[illegible]	0	34.1	6.8	6.7	13	4	25	20	20	•	17:50 - HARDNESS - 45 mg/l
1850	5.0	[illegible]	3.1	2.4	0.13	1.0	3.3	0	21.5	0										Al [illegible] 0.07 m/l
BACKWASH Terminating run #8 occured at 2:30 Am 1/30/87																				1700 [illegible]
900	[illegible]	[illegible]	2.5	2.2	0.40	0.7	5.6	0	21.5	0	34.6	6.8	6.7	13	5			20	0	Average 100 [illegible]
[illegible]	[illegible]	[illegible]	2.6	2.2	0.71	0.8	5.9	0	[illegible]	0	34.4	6.8	6.7	13	5	28.5	18	20	0	
	↑	[illegible]	2.11	1.79							[illegible]	6.8	6.7			37.36	13.2	20	--	

This data was from the morning of 1/30 not realizing that the run had terminated during the night and was nearing 8 ft of headloss for the second time

RMG/9/22/86

LOCATION ________ RUN NO. 9a DATES: 12/[illegible] CLARIFIER RATE [illegible] gpm/sq.ft. FILTER RATE [illegible] gpm/sq.ft.

EQUIPMENT ________

CLARIFIER FLUSH DURATION TIMERS

AIR(MIN) ______ AIR+WATER(MIN) ______

WTR WASH (MIN) ______ TIME BTWN FLUSH(HRS) ______

FILTER BACKWASH

MINUTES ______

GPM ______

TTL RUN LGTH (HRS) 8.5

TIME	ELAP TIME HOURS	TURBIDITY, NTU RAW	TURBIDITY, NTU CLAR INF	TURBIDITY, NTU CLAR EFF	TURBIDITY, NTU FILT EFF	HEADLOSS, FT CLAR	HEADLOSS, FT FILT	AQUARITROL TURB SET PT	AQUARITROL CHEM FEED%	AQUARITROL DEAD BAND	TEMP RAW	pH RAW	pH EFF	COLOR RAW	COLOR EFF	ALK RAW	ALK EFF	CHEMICAL FEED MG/L ALUM	CHEMICAL FEED MG/L POLYMER	
																			% / 12	[illegible] Stern PAC Polymer [illegible]
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14.8	0.011	36	6.8	6.6	16	4			10.5		[illegible] 16:5
7:30	1.0	[illegible]	[illegible]	[illegible]	[illegible]	2.5	2.4	0.10	14.7	0.011	[illegible]	6.8	[illegible]	16	5	22	[illegible]		17.5 / 0.05	[illegible] 16:30
[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	16	[illegible]					[illegible]
19:[illegible]	[illegible]	[illegible]	[illegible]	0.93	0.10	[illegible]	2.9	0.10	14.8	0.04	35.8	6.8	6.7	15	4			10.5		[illegible]
2030	1.0	[illegible]	2.1	1.1	0.10	0.9	3.3	0.10	14.5	0.011	36.5	6.8	6.7	15	5			10.5	17.5 / 0.05	2030 Alu [illegible] / 0.015
0100	8	[illegible]	ended																	
[illegible]			0100 AM																	
																				[illegible]
		.86	2.1	.76	.114						35.6	6.8	6.6	15.6	4.6			10.5	17.5 / .05	[illegible]

ENG/9/22/86

LOCATION ____________ RUN NO. 1 DATES: 1 CLARIFIER RATE 12 gpm/sq.ft. FILTER RATE 5 gpm/sq.ft.
EQUIPMENT 1

CLARIFIER FLUSH DURATION TIMERS
AIR(MIN) 1 AIR+WATER(MIN) 2
WTR WASH (MIN) [illegible] TIME BTWN FLUSH(HRS) 12 5:1

FILTER BACKWASH
MINUTES [illegible]
GPM [illegible]
TTL RUN LGTH (HRS) 10

TIME	ELAP TIME HOURS	TURBIDITY, NTU RAW	CLAR INF	CLAR EFF	FILT EFF	HEADLOSS, FT CLAR	FILT	AQUARITROL TURB SET PT	CHEM FEED%	DEAD BAND	TEMP RAW	pH RAW	pH EFF	COLOR RAW	EFF	ALK RAW	ALK EFF	CHEMICAL FEED MG/L ALUM	POLYMER	
[illegible]	[illegible]	[illegible]	[illegible]	0.71	[illegible]	0.4	1.9	0.1	[illegible]	[illegible]	37	6.9	[illegible]	15	5				22	[illegible] 280 [illegible] 13:48 [illegible] only fed this run
1136	1.0	0.34	0.8	0.62	0.12	0.5		0.10		0.01				15.	5	38	32			
1336	2.0	0.32	0.92	0.70	0.11	0.6	3.2	0.10	41.5	0.04	37.5	6.8	6.7	15	7					
1436	3.0	0.35	0.94	0.55	0.1	0.7	3.6	0.10	41.9	0.04		6.7	6.6	14	5	34	30			
1530	4.0	0.40	1.0	0.62	0.12	0.7	3.9	0.10	41.9	0.04	37	6.8	6.6	14	5				27	Al 1430 0.05 mg/l
1630	5.0	0.36	[illegible]	0.60	0.15	0.7	4.5	0.10	42.4	0.04	38	6.9	6.7	14	5	39	33			
1730	6.0	0.31	0.79	0.62	0.12	0.8		0.10	41.9	0.01	38.0	6.8	6.7							Influent iron 0.3 mg/l
1830	8.0	0.30	0.81	0.57	0.10	0.9	6.0	0.10	41.9	0.01	35.	6.8	6.7	14	6				27	effluent iron <0.1 mg/l
2030	9.0	0.29	0.93	0.29	0.16	1.0	6.4	0.10	41.9	0.04										no collected on effluent manganese [illegible]
[illegible]	10		Backwash																	
		.331	.881	[illegible]	.147						36.42	6.8	6.67	14.4	5.4	37	31.7	--	25.3	
																				aluminum residual @ 1740 0.25 mg/l
																				[illegible]

ENG/9/22/86

LOCATION Kirkland LK pwl RUN NO. 11 DATES: 2/4 2/5 CLARIFIER RATE 10 gpm/sq.ft. FILTER RATE 5 gpm/sq.ft.
EQUIPMENT 18:05 ...

CLARIFIER FLUSH DURATION TIMERS
AIR(MIN) 1 AIR+WATER(MIN) 3.5
WTR WASH (MIN) 4.5 TIME BTWN FLUSH(HRS) 12 HRS (SET)

FILTER BACKWASH
MINUTES 11
GPM 27
TTL RUN LGTH (HRS) 27

TIME	ELAP TIME HOURS	TURBIDITY, NTU RAW	CLAR INF	CLAR EFF	FILT EFF	HEADLOSS, FT CLAR	FILT	AQUARITROL TUBE SET PT	CHEM FEED%	DEAD BAND	TEMP RAW	pH RAW	pH EFF	COLOR RAW	EFF	ALK RAW	ALK EFF	CHEMICAL FEED MG/L ALUM	POLYMER 981N/SW	
1110	0	0.31	2.6	1.0	0.10	0.4	2.2	0.10	58.6	0.04	34.1	6.8	6.7	14	5	33	29	7	0.05/4	Recorder ... 1110
1300	2.0	0.30	2.9	1.2	0.11	0.5	2.3	0.10	69.4	0.04	34.0	6.7	6.6	14	3			7	0.05/5	Aquaritrol SET ON ...
1400	3.0	0.31	2.9	1.0	0.11	0.5	2.4	0.10	69.4	0.04	34.0	6.7	6.6	14	3			8	0.05/5	Turbidity spike at 1120 - don't know why!
1500	4.0	0.31	2.7	0.9	0.08	0.6	2.6	0.10	70.6	0.04	33.8	6.8	6.7	14	2	30	24	8	0.05/5	up alum dose slightly at 1410
1600	5.0	0.31	2.6	1.1	0.06	0.6	2.7	0.10	37.5	0.04	33.5	6.5	6.7	14	3					Aluminum residual 0.026 mg/l
1700	6.0	0.32	2.5	1.0	0.07	0.7	2.8	0.10	35.6	0.04	33.2	6.8	6.6	14	2	28	22	7	0.05/5	switch control of aquaritrol
2000	9.0	0.31	2.1	0.82	0.08	0.9	3.2	0.10	35.6	0.04	33.2	6.7	6.6	13	2			7	0.05/5	from ... to alum
800	21.0	0.34	2.8	0.79	0.08	0.75	5.0	0.10	38.5	0.04	33.8	6.7	6.6	13	2	30	25	8	0.05/5	IRON INFLUENT 0.3 mg/l eff 0.15 mg/l
900	22	0.29	2.6	0.85	0.04	0.8	5.2	0.10	38.5	0.04	33.9	6.7	6.6	13	3					Aluminum 0.02 mg/l. Hardness 40 inf
1100	24	0.46	2.4	0.96	0.09	0.9	5.5	0.10	38.5	0.04	34.0							8	0/5	36 eff.
1300	26	0.31	2.1	1.0	0.10	0.4	5.8	0.10	45.0	0.04	34.0	6.7	6.6	13	2	20	24			11:00 manual flush and took
1400	27	0.30	2.9	0.93	0.04	0.5	6.0	0.10	41.5	0.04	34.0	6.8	6.6	13	2	28	22	7.5	0/5	985N off line.
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]		1.0	8.0	[illegible]						Runs well without 985N
		.31	2.64	.96	.084						33.8	6.75	6.63	13.6	2.62	29.8	24.3	7.6	.05/4.9	Samples taken for mineral.
																				at 1300 HRS and 2000 HRS
																				[illegible]

APPENDIX D

MINISTRY OF ENVIRONMENT
ANALYTICAL DATA

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                                                                    4522
Environment Ontario                                                 4823              Page    1
FINAL     REPORT                                                    4525     Printed  18/02/87

Municipality/Project     K I R K L A N D   L A K E                  4526 Submission:  P C 0 4 5 2 2
                                                                    4525
                                                                    45

Sampling Date(s)              J A N  2 4, 1 9 8 7  to   J A N  2 8, 1 9 8 7


  Program        0700801                 WATER TREATMENT RESEARCH  TECHNICAL ADVISORY
  Agency         01030106

Sampled by       GEMIN,J                 Date Submitted:  01/01/87,    Date Received:  03/02/87


 ..........  Mail this copy to  .........  Martin, G
                                           WRB:DRINKING WATER
                                           P.O.BOX 213,125 RESOURCES ROAD
                                           REXDALE,ONTARIO
                                           M9W 5L1


 Final reports to  Martin, G               WRB:DRINKING WATER     Telephone: 416-235-5829

--Field------------------------------------------------------------------------Sampling-----------
 Sample    Sampling Location      Sampling Location Description              Date     Time   Zone
 --------  -----------------     --------------------------------------      -------  -----  --
     K-5   CODE NOT GIVEN         KIRKLAND LAKE                              27/01/87  17:00  5

           Sample Description                         Lab Sample#  Remarks   Lab Sample#  Remarks
           -------------------------------------      -----------  --------  -----------  --------
           TRIDENT-CLARIFIER - 25HRS                    W06-0048               M06-0105

           TESTS REQUESTED:  G+REWT01                 G+REWT05
                             +LANGI

--Field------------------------------------------------------------------------Sampling-----------
 Sample    Sampling Location      Sampling Location Description              Date     Time   Zone
 --------  -----------------     --------------------------------------      -------  -----  --
     K-6   CODE NOT GIVEN         KIRKLAND LAKE                              27/01/87  17:00  5

           Sample Description                         Lab Sample#  Remarks   Lab Sample#  Remarks
           -------------------------------------      -----------  --------  -----------  --------
           TRIDENT-FILTERED - 24HRS - 7.7FT             W06-0049               M06-0106

           TESTS REQUESTED:  G+REWT01                 G+REWT05
                             +LANGI

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--Field-----------------------------------------------------------------------Sampling-----------
 Sample   Sampling Location     Sampling Location Description                  Date    Time   Zone
--------  ------------------    ---------------------------------------------  -------  -----  --
    K-7   CODE NOT GIVEN        KIRKLAND LAKE                                  28/01/87         5

          Sample Description                           Lab Sample#  Remarks  Lab Sample#  Remarks
          -------------------------------------------  -----------  -------  -----------  -------
          RAW WATER - RUN 6                              W06-0050              M06-0107

          TESTS REQUESTED:   G+REWT01                  G+REWT05

--Field-----------------------------------------------------------------------Sampling-----------
 Sample   Sampling Location     Sampling Location Description                  Date    Time   Zone
--------  ------------------    ---------------------------------------------  -------  -----  --
    K-8   CODE NOT GIVEN        KIRKLAND LAKE                                  28/01/87         5

          Sample Description                           Lab Sample#  Remarks  Lab Sample#  Remarks
          -------------------------------------------  -----------  -------  -----------  -------
          PROCTOR-PLLOT-SETTLED - 24HRS                  W06-0051              M06-0108

          TESTS REQUESTED:   G+REWT01                  G+REWT05
                             +LANGI

--Field-----------------------------------------------------------------------Sampling-----------
 Sample   Sampling Location     Sampling Location Description                  Date    Time   Zone
--------  ------------------    ---------------------------------------------  -------  -----  --
    K-9   CODE NOT GIVEN        KIRKLAND LAKE                                  28/01/87         5

          Sample Description                           Lab Sample#  Remarks  Lab Sample#  Remarks
          -------------------------------------------  -----------  -------  -----------  -------
          PROCTOR-PLLOT-FILTERED- 24HRS                  W06-0052              M06-0109

          TESTS REQUESTED:   G+REWT01                  G+REWT05
                             +LANGI

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Environment Ontario PC04522 KIRKLAND LAKE
FINAL REPORT

Printed 18/02/87

Sample Class: M

Results

Metals in Water ITC

Inquiries at: Prem Vijan / Pat Lachmaniuk 235-5860
Telephone: 416-235-5858

Field Sample	Sampling Location	Sampling Location Description Sample Description	LAB Sample#	Remarks	Sampling Date	Time	Zone
K-1	CODE NOT GIVEN	KIRKLAND LAKE RAW WATER RUN 6	M06-0101		24/01/87	10:10	5
K-2	CODE NOT GIVEN	KIRKLAND LAKE TRIDENT -CLARIFIER -4HRS	M06-0102		24/01/87	10:15	5
K-3	CODE NOT GIVEN	KIRKLAND LAKE TRIDENT -FILTERED- 41HRS,8FT H.L	M06-0103		24/01/87	10:15	5
K-4	CODE NOT GIVEN	KIRKLAND LAKE RAW WATER - RUN 7	M06-0104		27/01/87	17:00	5
K-5	CODE NOT GIVEN	KIRKLAND LAKE TRIDENT-CLARIFIER - 25HRS	M06-0105		27/01/87	17:00	5
K-6	CODE NOT GIVEN	KIRKLAND LAKE TRIDENT-FILTERED - 24HRS - 7.7FT	M06-0106		27/01/87	17:00	5

Field Sample Number... Test Description Code, Units of Measure Method	K-1 M06-0101	K-2 M06-0102	K-3 M06-0103	K-4 M06-0104	K-5 M06-0105	K-6 M06-0106
IRON, UNF TOTAL FEUT ,MG/L as Fe (Iron) 522AE2	.016	.015	.011	.024	.020	.010
MANGANESE, UNF TOTAL MNUT ,MG/L as Mn Manganese 522AE2	.007	.005	.005	.011	.006	.004
ALUMINUM, UNF TOTAL ALUT ,MG/L as Al (Aluminum) 522AE2	.007	.180	.036	.012	.370	.029
ARSENIC, UNF TOTAL ASUT ,MG/L as As (Arsenic) 540AF3	<.001<	<.001<	<.001<	<.001<	<.001<	<.001<
COPPER, UNF TOTAL CUUT ,MG/L as Cu (Copper) 522AE2	.001	.001	.003	.001	.003	.001
LEAD, UNF TOTAL PBUT ,MG/L as Pb (Lead) 522AE2	<.003<	<.003<	<.003<	< 003<	<.003<	<.003<
ZINC, UNF TOTAL ZNUT ,MG/L as Zn (Zinc) 522AE2	.004	.003	.008	.008	.012	.005

Environment Ontario
FINAL REPORT

PC04522 KIRKLAND LAKE

Printed 18/02/87

Sample Class: M

Results

Metals in Water ITC

Inquiries at: Prem Vijan / Pat Lachmaniuk 235-5860
Telephone: 416-235-5858

Field Sample	Sampling Location	Sampling Location Description Sample Description	LAB Sample#	Remarks	Sampling Date	Sampling Time	Zone
K-7	CODE NOT GIVEN	KIRKLAND LAKE RAW WATER - RUN 6	M06-0107		28/01/87		5
K-8	CODE NOT GIVEN	KIRKLAND LAKE PROCTOR-PLLOT-SETTLED - 24HRS	M06-0108		28/01/87		5
K-9	CODE NOT GIVEN	KIRKLAND LAKE PROCTOR-PLLOT-FILTERED- 24HRS	M06-0109		28/01/87		5

Field Sample Number ... Test Description Code, Units of Measure Method	K-7 M06-0107	K-8 M06-0108	K-9 M06-0109
IRON, UNF TOTAL FEUT ,MG/L as Fe (Iron) 522AE2	.019	.100	.066
MANGANESE, UNF TOTAL MNUT ,MG/L as Mn Manganese 522AE2	.011	.012	.011
ALUMINUM, UNF TOTAL ALUT ,MG/L as Al (Aluminum) 522AE2	.005	1.000	.780
ARSENIC, UNF TOTAL ASUT ,MG/L as As (Arsenic) 540AF3	<.001<	<.001<	<.001<
COPPER, UNF TOTAL CUUT ,MG/L as Cu (Copper) 522AE2	.003	.002	.007
LEAD, UNF TOTAL PBUT ,MG/L as Pb (Lead) 522AE2	<.003<	<.003<	<.003<
ZINC, UNF TOTAL ZNUT ,MG/L as Zn (Zinc) 522AE2	.005	.007	.025

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Sample Class W Results

WATER (GRND/DOMESTIC) WQ Inquiries at: JENIFER McBRIDE
Telephone: 416-235-5875

Field Sample	Sampling Location	Sampling Location Description Sample Description	LAB Sample#	Remarks	Sampling Date	Time	Zone
K-1	CODE NOT GIVEN	KIRKLAND LAKE RAW WATER RUN 6	W06-0044		24/01/87	10:10	5
K-2	CODE NOT GIVEN	KIRKLAND LAKE TRIDENT -CLARIFIER -4HRS	W06-0045		24/01/87	10:15	5
K-3	CODE NOT GIVEN	KIRKLAND LAKE TRIDENT -FILTERED- 41HRS,8FT H.L	W06-0046		24/01/87	10:15	5
K-4	CODE NOT GIVEN	KIRKLAND LAKE RAW WATER - RUN 7	W06-0047		27/01/87	17:00	5
K-5	CODE NOT GIVEN	KIRKLAND LAKE TRIDENT-CLARIFIER - 25HRS	W06-0048		27/01/87	17:00	5
K-6	CODE NOT GIVEN	KIRKLAND LAKE TRIDENT-FILTERED - 24HRS - 7.7FT	W06-0049		27/01/87	17:00	5

Field Sample Number ... Test Description Code, Units of Measure Method	K-1 W06-0044	K-2 W06-0045	K-3 W06-0046	K-4 W06-0047	K-5 W06-0048	K-6 W06-0049
CONDUCTIVITY 25C COND25,UMHO/CM at 25 D CENT. 002BI2	147.0	152.0	152.0	147.0	180.0	179.0
HARDNESS, TOTAL HARDT ,MG/L as CACO3 CALC01	48.5	48.5	49.0	49.0	47.0	48.0
CALCIUM, UNF REACTIVE CAUR ,MG/L as Ca (Calcium) 002AA1	13.6	13.6	13.8	13.6	13.3	13.4
MAGNESIUM, UNF REACTIVE MGUR ,MG/L as Mg Magnesium 001AA1	3.55	3.55	3.60	3.65	3.35	3.55
SODIUM, UNF REACT NAUR ,MG/L as Na (Sodium) 002BA1	9.5	9.4	9.2	9.4	14.7	14.8
POTASSIUM, UNF REACT KKUR ,MG/L as K (Potassium) 002BA1	.46	.40	.31	.32	.36	.38
ALKALINITY,TOTAL ALKT ,MG/L as CACO3 004AT6	38.7	35.9	35.9	39.1	36.3	37.0
PH (-LOG(H+(CONCN))) PH ,DIMENSIONLESS 003AI2	7.72	7.62	7.65	7.83	7.63	7.58
CHLORIDE, UNF REACTIVE CLIDUR,MG/L as Cl- Chloride 004AC1	16.80	16.8	17.40	16.70	25.10	24.60

Sample Class: W

Results

WATER (GRND/DOMESTIC) WQ

Inquiries at: JENIFER McBRIDE
Telephone: 416-235-5875

Field Sample Number . . . Test Description Code, Units of Measure Method	K-1 W06-0044	K-2 W06-0045	K-3 W06-0046	K-4 W06-0047	K-5 W06-0048	K-6 W06-0049
SULPHATE, UNF REACT SSO4UR,MG/L as SO4 Sulphate 003AI0	6.47	9.80	9.33	6.77	11.34	11.76
TURBIDITY TURB ,FORMAZIN TURB UNITS 002AI1	1.03	1.14	.31	.45	.56	.63
COLOUR, TRUE COLTR ,TRUE COLOUR UNITS 102BC9	15.0	4.5	4.0	14.0	2.5<T	4.5
PHOSPHORUS, UNF TOTAL PPUT ,MG/L as P Phosphorus 504BC2	.020<T	<.010<W	<.010<W	<.010<W	<.010<W	<.010<W
NITR'N,TOTAL KJELD,UNF.R NNTKUR,MG/L as N (Nitrogen) 004BC2	.20<T	.50	.30	.20<T	.30	.30
AMMONIUM,TOTL, FRAC REAC NNHTFR,MG/L as N (Nitrogen) 103AC2	<.05<W	<.05<W	<.05<W	.05<T	.05<T	<.05<W
NITRATES,TOTL, FRAC REAC NNOTFR,MG/L as N (Nitrogen) 102CC2	.05<T	.05<T	.10<T	.10<T	.10<T	.10<T
NITRITE, FRAC REACT NNO2FR,MG/L as N (Nitrogen) 102CC2	.005<T	.005<T	.005<T	.010<T	.005<T	.005<T
DISSOLVED ORGANIC CARBON DOC ,MG/L as C (Carbon) 102AC2	5.8	IBT No Units No Method	4.1	6.0	4.6	4.5
LANGELIER'S INDEX LANGI ,DIMENSIONLESS CALC01		-.95	-.91		-.95	108 No Units No Method

Field Sample	Sampling Location	Sampling Location Description Sample Description	LAB Sample#	Remarks	Samplin Date	Ti
K-7	CODE NOT GIVEN	KIRKLAND LAKE RAW WATER - RUN 6	W06-0050		28/01/87	
K-8	CODE NOT GIVEN	KIRKLAND LAKE PROCTOR-PLLOT-SETTLED - 24HRS	W06-0051		28/01/87	5
K-9	CODE NOT GIVEN	KIRKLAND LAKE PROCTOR-PLLOT-FILTERED- 24HRS	W06-0052		28/01/87	5

Field Sample Number Test Description Code, Units of Measure Method	K-7 W06-0050	K-8 W06-0051	K-9 W06-0052
CONDUCTIVITY 25C COND25,UMHO/CM at 25 D CENT. 002BI2	147.0	152.0	151.0
HARDNESS, TOTAL HARDT ,MG/L as CACO3 CALC01	47.5	46.5	48.0
CALCIUM, UNF REACTIVE CAUR ,MG/L as Ca (Calcium) 002AA1	13.4	13.1	13.4
MAGNESIUM, UNF REACTIVE MGUR ,MG/L as Mg Magnesium 001AA1	3.45	3.40	3.45
SODIUM, UNF REACT NAUR ,MG/L as Na (Sodium) 002BA1	9.4	9.8	9.3
POTASSIUM, UNF REACT KKUR ,MG/L as K (Potassium) 002BA1	.32	.34	.29
ALKALINITY,TOTAL ALKT ,MG/L as CACO3 004AT6	39.0	33.4	33.3
PH (-LOG(H+(CONCN))) PH ,DIMENSIONLESS 003AI2	7.68	7.34	7.45
CHLORIDE, UNF REACTIVE CLIDUR,MG/L as Cl- Chloride 004AC1	16.90	16.80	16.80

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FINAL REPORT

Sample Class W Results

WATER (GRND/DOMESTIC) WQ

Inquiries at: JENIFER McBRIDE
Telephone: 416-235-5875

Field Sample Number Test Description Code, Units of Measure Method	K-7 W06-0050	K-8 W06-0051	K-9 W06-0052
SULPHATE, UNF REACT SSO4UR,MG/L as SO4 Sulphate 003AI0	6.98	14.75	14.66
TURBIDITY TURB ,FORMAZIN TURB UNITS 002AI1	.53	1.33	1.03
COLOUR, TRUE COLTR ,TRUE COLOUR UNITS 102BC9	14.0	16.5	13.5
PHOSPHORUS, UNF TOTAL PPUT ,MG/L as P Phosphorus 504BC2	<.010<W	<.010<W	<.010<W
NITR'N,TOTAL KJELD,UNF R NNTKUR,MG/L as N (Nitrogen) 004BC2	.20<T	.20<T	.20<T
AMMONIUM,TOTL, FRAC REAC NNHTFR,MG/L as N (Nitrogen) 103AC2	<.05<W	<.05<W	<.05<W
NITRATES,TOTL, FRAC REAC NNOTFR,MG/L as N (Nitrogen) 102CC2	.05<T	.05<T	<.05<W
NITRITE, FRAC REACT NNO2FR,MG/L as N (Nitrogen) 102CC2	.005<T	.010<T	.005<T
DISSOLVED ORGANIC CARBON DOC ,MG/L as C (Carbon) 102AC2	5.8	5.9	5.5
LANGELIER'S INDEX LANGI ,DIMENSIONLESS CALC01		-1.28	-1.16

Sample Class ##

Results

DERIVED RESULTS

Inquiries at: WATER QUALITY OFFICE
Telephone: 416-248-3512

Field Sample	Sampling Location	Sampling Location Description Sample Description	LAB Sample#	Remarks	Sampling Date	Sampling Time	Zone
K-1	CODE NOT GIVEN	KIRKLAND LAKE RAW WATER RUN 6	ION-CAL		24/01/87	10:10	5
K-2	CODE NOT GIVEN	KIRKLAND LAKE TRIDENT -CLARIFIER -4HRS	ION-CAL		24/01/87	10:15	5
K-3	CODE NOT GIVEN	KIRKLAND LAKE TRIDENT -FILTERED- 41HRS,8FT H.L	ION-CAL		24/01/87	10:15	5
K-4	CODE NOT GIVEN	KIRKLAND LAKE RAW WATER - RUN 7	ION-CAL		27/01/87	17:00	5
K-5	CODE NOT GIVEN	KIRKLAND LAKE TRIDENT-CLARIFIER - 25HRS	ION-CAL		27/01/87	17:00	5
K-6	CODE NOT GIVEN	KIRKLAND LAKE TRIDENT-FILTERED - 24HRS - 7.7FT	ION-CAL		27/01/87	17:00	5

Field Sample Number... Test Description Code, Units of Measure Method	K-1 ION-CAL	K-2 ION-CAL	K-3 ION-CAL	K-4 ION-CAL	K-5 ION-CAL	K-6 ION-CAL
ION BALANCE CALCULATION CONDTY,UMHO/CM AT 25C	154.7		158.3	155.8	187.2	188.5
ION BALANCE CALCULATION DISOL ,MG/L	74.20		75.97	74.79	90.79	91.49
ION BALANCE CALCULATION IONBL ,%	.7064	NAF	1.221	.1063	5.370	4.417

Environment Ontario   PC04522   KIRKLAND LAKE
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Sample Class ##   Results

DERIVED RESULTS

Inquiries at: WATER QUALITY OFFICE
Telephone: 416-248-3512

Field Sample	Sampling Location	Sampling Location Description Sample Description	LAB Sample#	Remarks	Sampling Date	Time	Zone
K-7	CODE NOT GIVEN	KIRKLAND LAKE RAW WATER - RUN 6	ION-CAL		28/01/87		5
K-8	CODE NOT GIVEN	KIRKLAND LAKE PROCTOR-PLLOT-SETTLED - 24HRS	ION-CAL		28/01/87		5
K-9	CODE NOT GIVEN	KIRKLAND LAKE PROCTOR-PLLOT-FILTERED- 24HRS	ION-CAL		28/01/87		5

Field Sample Number... Test Description Code, Units of Measure Method	K-7 ION-CAL	K-8 ION-CAL	K-9 ION-CAL
ION BALANCE CALCULATION CONDTY,UMHO/CM AT 25C	154.5	162.0	161.4
ION BALANCE CALCULATION DISOL ,MG/L	74.45	78.78	78.20
ION BALANCE CALCULATION IONBL ,%	2.609	6.115	5.882

```
--------------------------------------------------------------------------------------------
                              REMARK CODE EXPLANATIONS
                              ------------------------
                      RMK _____________DESCRIPTION_________________
                      !BT NO DATA: SAMPLE BROKEN IN TRANSIT
                      !OS NO DATA: OPTIONAL SAMPLE.
                      <   ACTUAL RESULT IS LESS THAN THE REPORTED VALUE
                      <T  THIS LOW MEASUREMENT IS TENTATIVE. FOR INFO ONLY
                      <W  "ZERO". VALUE REPORTED IS MIN. MEASURABLE AMOUNT
                      NAF NOT ALL REQUIRED TESTS FOUND
*** END OF REPORT ***
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[illegible]

[illegible]                                                            Page   1
[illegible]                                                         Printed  06/03/87

Municipality/Project:  K I R K L A N D   L A K E              Submission:  P C 0 4 0 5 2


Sampling Date(s):          F E B  0 2, 1 9 8 7  to  F E B  0 5, 1 9 8 7


  Program......  0700601                  WATER TREATMENT RESEARCH  TECHNICAL ADVISORY
  Agency.......  01030106
Sampled by:     HANNAH BOBB            Date Submitted:  11/02/87,    Date Received:  12/02/87


..........  Mail this copy to  .......... Martin, G
                                          WRB:DRINKING WATER
                                          P.O.BOX 213,125 RESOURCES ROAD
                                          REXDALE,ONTARIO
                                          M9W 5L1


  Final reports to  Martin, G             WRB:DRINKING WATER     Telephone: 416-235-5829
-----------------------------------------------------------------------------------------
  Field                                                                  Sampling
  Sample   Sampling Location    Sampling Location Description          Date     Time   Zone
  -------- -------------------  ------------------------------------  -------- -----  --
    3K-1   CODE NOT GIVEN       KIRKLAND LAKE  RUN 9  1900 HRS.        02/02/87  19:00  5

           Sample Description                     Lab Sample#  Remarks  Lab Sample#  Remarks
           -------------------------------------  -----------  -------  -----------  -------
           RAW INFLUENT                             W07-0048

           TESTS REQUESTED:  G+REWT01            -FEUT
                             -MNUT
-----------------------------------------------------------------------------------------
  Field                                                                  Sampling
  Sample   Sampling Location    Sampling Location Description          Date     Time   Zone
  -------- -------------------  ------------------------------------  -------- -----  --
    3K-2   CODE NOT GIVEN       1900 HRS.                              02/02/87  19:00  5

           Sample Description                     Lab Sample#  Remarks  Lab Sample#  Remarks
           -------------------------------------  -----------  -------  -----------  -------
           CLARIFIER EFFLUENT                       W07-0049

           TESTS REQUESTED:  G+REWT01            -FEUT
                             -MNUT

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```
  [illegible]   Date  6 MAR 1987, Frame  165, Location K  3, Submission  PC04652

  Environment Ontario          PC04652        KIRKLAND LAKE                          Page   2
  Final     REPORT                                                            Printed  06/03/87

---------------------------------------------------------------------------------------------
 Field                                                                         Sampling
 Sample   Sampling Location    Sampling Location Description              Date     Time   Zone
 ------   -----------------    -----------------------------------      --------  -----   --
   3K-3   CODE NOT GIVEN       RUN 9  1900 HRS.                           02/02/87  19:00   5

          Sample Description                           Lab Sample#  Remarks  Lab Sample#  Remarks
          ----------------------------------------    -----------  -------  -----------  -------
          FILTER EFFLUENT                               W07-0050

          TESTS REQUESTED:  G+REWT01                  -FEUT
                            -MNUT
---------------------------------------------------------------------------------------------
 Field                                                                         Sampling
 Sample   Sampling Location    Sampling Location Description              Date     Time   Zone
 ------   -----------------    -----------------------------------      --------  -----   --
   3K-4   CODE NOT GIVEN       RUN 10 1650 HRS.                           03/02/87  16:50   5

          Sample Description                           Lab Sample#  Remarks  Lab Sample#  Remarks
          ----------------------------------------    -----------  -------  -----------  -------
          RAW WATER                                     W07-0051              W07-0092

          TESTS REQUESTED:  G+REWT01                  G+REWT05
---------------------------------------------------------------------------------------------
 Field                                                                         Sampling
 Sample   Sampling Location    Sampling Location Description              Date     Time   Zone
 ------   -----------------    -----------------------------------      --------  -----   --
   3K-5   CODE NOT GIVEN       RUN 10 1650 HRS.                           03/02/87  16:50   5

          Sample Description                           Lab Sample#  Remarks  Lab Sample#  Remarks
          ----------------------------------------    -----------  -------  -----------  -------
          CLARIFIER                                     W07-0052              W07-0093

          TESTS REQUESTED:  G+REWT01                  G+REWT05
---------------------------------------------------------------------------------------------
 Field                                                                         Sampling
 Sample   Sampling Location    Sampling Location Description              Date     Time   Zone
 ------   -----------------    -----------------------------------      --------  -----   --
   3K-6   CODE NOT GIVEN       RUN 10 1650 HRS.                           03/02/87  16:50   5

          Sample Description                           Lab Sample#  Remarks  Lab Sample#  Remarks
          ----------------------------------------    -----------  -------  -----------  -------
          FILTER                                        W07-0053              W07-0094

          TESTS REQUESTED:  G+REWT01                  G+REWT05
---------------------------------------------------------------------------------------------
```

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[illegible] REPORTS - Date  6 MAR 1987, Frame  165, Location L  3, Submission  PC04652

Environment Ontario          PC04652       KIRKLAND LAKE                              Page   3
[illegible]     REPORT                                                             Printed  06/03/87

------------------------------------------------------------------------------------------------
Field                                                                         Sampling
Sample   Sampling Location    Sampling Location Description                 Date     Time   Zone
------   ------------------   ------------------------------------------   --------  -----   --
  3K-7   CODE NOT GIVEN       KIRKLAND LAKE   RUN 10   1950 HRS.           03/02/87  19:50   5

         Sample Description                         Lab Sample#  Remarks  Lab Sample#  Remarks
         ----------------------------------------   -----------  -------  -----------  -------
         RAW WATER                                    W07-0054

         TESTS REQUESTED:  G+REWT01                -FEUT
                           -MNUT

------------------------------------------------------------------------------------------------
Field                                                                         Sampling
Sample   Sampling Location    Sampling Location Description                 Date     Time   Zone
------   ------------------   ------------------------------------------   --------  -----   --
  3K-8   CODE NOT GIVEN       KIRKLAND LAKE   RUN 10   1950 HRS.           03/02/87  19:50   5

         Sample Description                         Lab Sample#  Remarks  Lab Sample#  Remarks
         ----------------------------------------   -----------  -------  -----------  -------
         CLARIFIER                                    W07-0055

         TESTS REQUESTED:  G+REWT01                -FEUT
                           -MNUT

------------------------------------------------------------------------------------------------
Field                                                                         Sampling
Sample   Sampling Location    Sampling Location Description                 Date     Time   Zone
------   ------------------   ------------------------------------------   --------  -----   --
  3K-9   CODE NOT GIVEN       KIRKLAND LAKE   RUN 10   1950 HRS.           03/02/87  19:50   5

         Sample Description                         Lab Sample#  Remarks  Lab Sample#  Remarks
         ----------------------------------------   -----------  -------  -----------  -------
         FILTER                                       W07-0056

         TESTS REQUESTED:  G+REWT01                -FEUT
                           -MNUT

------------------------------------------------------------------------------------------------
Field                                                                         Sampling
Sample   Sampling Location    Sampling Location Description                 Date     Time   Zone
------   ------------------   ------------------------------------------   --------  -----   --
 3K-10   CODE NOT GIVEN       KIRKLAND LAKE   RUN 11   1500 HRS.           05/02/87  15:00   5

         Sample Description                         Lab Sample#  Remarks  Lab Sample#  Remarks
         ----------------------------------------   -----------  -------  -----------  -------
         RAW WATER                                    W07-0095

         TESTS REQUESTED:  G+REWT05

------------------------------------------------------------------------------------------------
```

```
[illegible] Date 6 MAR 1987, Frame  165, Location M  3, Submission  PC04652

[illegible]ment Ontario            PC04652       KIRKLAND LAKE                       Page   4
[illegible]  REPORT                                                          Printed  06/03/87

--------------------------------------------------------------------------------------------
Field                                                                       Sampling
Sample  Sampling Location    Sampling Location Description            Date    Time   Zone
------  -----------------    ------------------------------------     ------  -----  --
 3K-11  CODE NOT GIVEN       KIRKLAND LAKE  RUN 11  1500 HRS.         05/02/87 15:00  5

        Sample Description                   Lab Sample#  Remarks  Lab Sample#  Remarks
        -----------------------------------  -----------  -------  -----------  -------
        CLARIFIER                              H07-0057               H07-0096

        TESTS REQUESTED:  G+REHT01             G+REHT05

--------------------------------------------------------------------------------------------
Field                                                                       Sampling
Sample  Sampling Location    Sampling Location Description            Date    Time   Zone
------  -----------------    ------------------------------------     ------  -----  --
 3K-12  CODE NOT GIVEN       KIRKLAND LAKE  RUN 11  1500 HRS.         05/02/87 15:00  5

        Sample Description                   Lab Sample#  Remarks  Lab Sample#  Remarks
        -----------------------------------  -----------  -------  -----------  -------
        FILTER                                 H07-0058               H07-0097

        TESTS REQUESTED:  G+REHT01             G+REHT05

--------------------------------------------------------------------------------------------
Field                                                                       Sampling
Sample  Sampling Location    Sampling Location Description            Date    Time   Zone
------  -----------------    ------------------------------------     ------  -----  --
 3K-13  CODE NOT GIVEN       KIRKLAND LAKE  RUN 11  2000 HRS.         05/02/87 20:00  5

        Sample Description                   Lab Sample#  Remarks  Lab Sample#  Remarks
        -----------------------------------  -----------  -------  -----------  -------
        FILTER                                 H07-0059               H07-0098

        TESTS REQUESTED:  G+REHT01             G+REHT05

--------------------------------------------------------------------------------------------
```

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   REPORTS - Date  6 MAR 1987, Frame  165, Location N  3, Submission  PC04652

    nment Ontario           PC04652        KIRKLAND LAKE                        Page   5
        REPORT                                                          Printed  06/03/87

 ample Class:  M                           Results

Metals in Water      ITC                      Inquiries at: Prem Vijan / Pat Lachmaniuk 235-6004
                                                  Telephone: 416-235-5834

-------------------------------------------------------------------------------------------------
 Field                              Sampling Location Description       LAB                 Sampling
 Sample  Sampling Location          Sample Description                  Sample#  Remarks   Date   Time Zone
 ------- -----------------          ---------------------------         -------- -------  -------- ----- ---



   3K-4 CODE NOT GIVEN             RUN 10 1650 HRS.                                      03/02/87 16:50 5
                                    RAW WATER                           M07-0092
   3K-5 CODE NOT GIVEN             RUN 10 1650 HRS.                                      03/02/87 16:50 5
                                    CLARIFIER                           M07-0093
   3K-6 CODE NOT GIVEN             RUN 10 1650 HRS.                                      03/02/87 16:50 5
                                    FILTER                              M07-0094

-------------------------------------------------------------------------------------------------
    Field Sample Number...                                               3K-4       3K-5       3K-6
 Test Description
 Code,  Units of Measure                                               M07-0092   M07-0093   M07-0094
 ---------------- Method    ---------- ---------- ----------   ---------- ---------- ----------

 IRON, UNF.TOTAL                                                          .018       .020       .004
 FEUT   ,MG/L as Fe (Iron)
                 522AE2
 MANGANESE, UNF.TOTAL                                                     .015       .014       .011
 MNUT   ,MG/L as Mn  Manganese
                 522AE2
 ALUMINUM, UNF.TOTAL                                                      .005      1.100       .082
 ALUT   ,MG/L as Al (Aluminum)
                 522AE2
 ARSENIC, UNF.TOTAL                                                     <.001<     <.001<     <.001<
 ASUT   ,MG/L as As (Arsenic)
                 540AF3
 COPPER, UNF.TOTAL.                                                       .001       .001       .001
 CUUT   ,MG/L as Cu (Copper)
                 522AE2
 LEAD, UNF.TOTAL                                                        <.003<     <.003<     <.003<
 PBUT   ,MG/L as Pb (Lead)
                 522AE2
 ZINC, UNF.TOTAL                                                          .013       .009       .006
 ZNUT   ,MG/L as Zn (Zinc)
                 522AE2
```

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LIS REPORTS - Date  6 MAR 1987, Frame  165, Location 0  3, Submission  PC04652

Environment Ontario          PC04652        KIRKLAND LAKE                            Page   6
Final    REPORT                                                              Printed  06/03/87

Sample Class:  M                         Results

Metals in Water       ITC                  Inquiries at: Prem Vijan / Pat Lachmaniuk 235-6004
                                              Telephone: 416-235-5834

-------------------------------------------------------------------------------------------------
 Field                              Sampling Location Description     LAB                 Sampling
 Sample  Sampling Location          Sample Description                Sample#  Remarks  Date    Time Zone
 -------- -----------------         ------------------------------  -------- -------- -------- ----- ---



  3K-10 CODE NOT GIVEN              KIRKLAND LAKE   RUN 11   1500 HRS.                    05/02/87 15:00 5
                                    RAW WATER                         M07-0095
  3K-11 CODE NOT GIVEN              KIRKLAND LAKE   RUN 11   1500 HRS.                    05/02/87 15:00 5
                                    CLARIFIER                         M07-0096
  3K-12 CODE NOT GIVEN              KIRKLAND LAKE   RUN 11   1500 HRS.                    05/02/87 15:00 5
                                    FILTER                            M07-0097

-------------------------------------------------------------------------------------------------
   Field Sample Number...                                           3K-10      3K-11      3K-12
Test Description
Code,  Units of Measure                                           M07-0095   M07-0096   M07-0097
----------------- Method   ---------- ---------- ----------  ---------- ---------- ----------
                                                                   .016       .033       .011
IRON, UNF.TOTAL
FEUT  ,MG/L as Fe (Iron)
                522AE2
MANGANESE, UNF.TOTAL                                               .016       .015       .011
MNUT  ,MG/L as Mn  Manganese
                522AE2
ALUMINUM, UNF.TOTAL                                              <.004<       .290       .250
ALUT  ,MG/L as Al (Aluminum)
                522AE2
ARSENIC, UNF.TOTAL                                               <.001<     <.001<     <.001<
ASUT  ,MG/L as As (Arsenic)
                540AF3
COPPER, UNF.TOTAL.                                                 .001       .002       .001
CUUT  ,MG/L as Cu (Copper)
                522AE2
LEAD, UNF.TOTAL                                                    .009     <.003<     <.003<
PBUT  ,MG/L as Pb (Lead)
                522AE2
ZINC, UNF.TOTAL                                                    .006       .020       .004
ZNUT  ,MG/L as Zn (Zinc)
                522AE2
```

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LIS REPORTS - Date  6 MAR 1987, Frame  165, Location A  4, Submission  PC04652

Environment Ontario             PC04652        KIRKLAND LAKE                                   Page   7
FINAL     REPORT                                                                      Printed  06/03/87

Sample Class:  M                                 Results

Metals in Water       ITC                           Inquiries at: Prem Vijan / Pat Lachmaniuk 235-6004
                                                       Telephone: 416-235-5834

--------------------------------------------------------------------------------------------------------
 Field                                  Sampling Location Description     LAB                   Sampling
 Sample   Sampling Location             Sample Description                Sample#  Remarks   Date    Time Zone
 -------- ------------------            ----------------------------      -------- -------   -------- ----- ---

    3K-13 CODE NOT GIVEN                KIRKLAND LAKE  RUN 11  2000 HRS.                      05/02/87 20:00 5
                                        FILTER                            M07-0098








--------------------------------------------------------------------------------------------------------
     Field Sample Number...      3K-13
Test Description
Code,  Units of Measure         M07-0098
----------------- Method     ---------- ---------- ---------- ---------- ---------- ----------

IRON, UNF.TOTAL                  .016
FEUT  ,MG/L as Fe (Iron)
                 522AE2
MANGANESE, UNF.TOTAL             .015
MNUT  ,MG/L as Mn  Manganese
                 522AE2
ALUMINUM, UNF.TOTAL              .024
ALUT  ,MG/L as Al (Aluminum)
                 522AE2
ARSENIC, UNF.TOTAL              <.001<
ASUT  ,MG/L as As (Arsenic)
                 540AF3
COPPER, UNF.TOTAL.               .001
CUUT  ,MG/L as Cu (Copper)
                 522AE2
LEAD, UNF.TOTAL                 <.003<
PBUT  ,MG/L as Pb (Lead)
                 522AE2
ZINC, UNF.TOTAL                  .008
ZNUT  ,MG/L as Zn (Zinc)
                 522AE2
```

```
REPORTS - Date  6 MAR 1987, Frame  165, Location B  4, Submission  PC04652

Environment Ontario             PC04652        KIRKLAND LAKE                              Page   8
FINAL    REPORT                                                                  Printed  06/03/87

Sample Class:  W                            Results

WATER (GRND/DOMESTIC) WQ                            Inquiries at: JENIFER McBRIDE
                                                       Telephone: 416-235-5875

------------------------------------------------------------------------------------------------------
 Field                             Sampling Location Description       LAB                  Sampling
 Sample   Sampling Location        Sample Description                  Sample#  Remarks   Date   Time Zone
 -------- ------------------------ ----------------------------------- -------- -------- -------- ----- ---

    3K-1 CODE NOT GIVEN            KIRKLAND LAKE  RUN 9  1900 HRS.                        02/02/87 19:00 5
                                   RAW INFLUENT                        W07-0048
    3K-2 CODE NOT GIVEN            1900 HRS.                                              02/02/87 19:00 5
                                   CLARIFIER EFFLUENT                  W07-0049
    3K-3 CODE NOT GIVEN            RUN 9  1900 HRS.                                       02/02/87 19:00 5
                                   FILTER EFFLUENT                     W07-0050
    3K-4 CODE NOT GIVEN            RUN 10 1650 HRS.                                       03/02/87 16:50 5
                                   RAW WATER                           W07-0051
    3K-5 CODE NOT GIVEN            RUN 10 1650 HRS.                                       03/02/87 16:50 5
                                   CLARIFIER                           W07-0052
    3K-6 CODE NOT GIVEN            RUN 10 1650 HRS.                                       03/02/87 16:50 5
                                   FILTER                              W07-0053

------------------------------------------------------------------------------------------------------
   Field Sample Number...       3K-1        3K-2        3K-3        3K-4        3K-5        3K-6
Test Description
Code,  Units of Measure       W07-0048    W07-0049    W07-0050    W07-0051    W07-0052    W07-0053
------------------ Method  ----------- ----------- ----------- ----------- ----------- -----------

CONDUCTIVITY 25C               146.0       160.0       170.0       146.0       151.0       151.0
COND25,UMHO/CM at 25 D.CENT.
                   002BI2
HARDNESS, TOTAL                 48.0        48.5        48.5        48.0        48.5        48.0
HARDT ,MG/L as CACO3
                   CALC01
CALCIUM, UNF.REACTIVE           13.7        13.7        13.8        13.7        13.7        13.5
CAUR  ,MG/L as Ca (Calcium)
                   002AA1
MAGNESIUM, UNF.REACTIVE         3.35        3.45        3.45        3.40        3.45        3.40
MGUR  ,MG/L as Mg  Magnesium
                   001AA1
SODIUM, UNF.REACT.              10.1        10.2        10.4        10.4        10.5        10.3
NAUR  ,MG/L as Na (Sodium)
                   002BA1
POTASSIUM, UNF.REACT.            .44         .42         .39         .35         .36         .42
KKUR  ,MG/L as K (Potassium)
                   002BA1
ALKALINITY,TOTAL                38.8        20.0         4.7        38.6        34.7        34.4
ALKT  ,MG/L as CACO3
                   004AT6
PH (-LOG(H+(CONCN)))            7.75        6.73        5.62        7.72        7.58        7.46
PH    ,DIMENSIONLESS
                   003AI2
CHLORIDE, UNF.REACTIVE         16.80       19.40       19.00       17.10       19.50       19.60
CLIDUR,MG/L as Cl-  Chloride
```

Environment Ontario PC04652 KIRKLAND LAKE
FINAL REPORT

Sample Class: W Results

WATER (GRND/DOMESTIC) WQ

Inquiries at: JENIFER McBRIDE
Telephone: 416-235-5875

Field Sample Number ... Test Description Code, Units of Measure Method	3K-1 W07-0048	3K-2 W07-0049	3K-3 W07-0050	3K-4 W07-0051	3K-5 W07-0052	3K-6 W07-0053
SULPHATE, UNF.REACT. SSO4UR,MG/L as SO4 Sulphate 003AI0	9.60	23.20	40.78	9.74	8.87	8.52
TURBIDITY TURB ,FORMAZIN TURB. UNITS 002AI1	.57	.64	1.44	.56	.86	.35
COLOUR, TRUE COLTR ,TRUE COLOUR UNITS 102BC9	14.5	4.0	2.5<T	14.5	8.5	6.0
PHOSPHORUS, UNF.TOTAL PPUT ,MG/L as P Phosphorus 504BC2	.010<T	<.010<W	<.010<W	.010<T	.010<T	.010<T
NITR'N,TOTAL KJELD,UNF.R NNTKUR,MG/L as N (Nitrogen) 004BC2	.10<T	<.05<W	<.05<W	.10<T	.10<T	.10<T
AMMONIUM,TOTL, FRAC.REAC NNHTFR,MG/L as N (Nitrogen) 103AC2	<.05<W	.05<T	.20<T	.10<T	.10<T	.05<T
NITRATES,TOTL, FRAC.REAC NNOTFR,MG/L as N (Nitrogen) 102CC2	.10<T	.10<T	.10<T	.15<T	.15<T	.15<T
NITRITE, FRAC.REACT. NNO2FR,MG/L as N (Nitrogen) 102CC2	.005<T	.005<T	.005<T	.005<T	.005<T	.005<T
DISSOLVED ORGANIC CARBON DOC ,MG/L as C (Carbon) 102AC2	6.2	2.8	2.3	6.2	5.0	4.4

```
[illegible]   Date  6 MAR 1987, Frame  165, Location D  4, Submission  PC04652

Environment Ontario          PC04652         KIRKLAND LAKE                            Page  10
FINAL      REPORT                                                          Printed  06/03/87

Sample Class:  W                         Results

WATER (GRND/DOMESTIC) WQ                     Inquiries at: JENIFER McBRIDE
                                               Telephone: 416-235-5875

------------------------------------------------------------------------------------------
 Field                             Sampling Location Description     LAB               Sampling
 Sample  Sampling Location         Sample Description                SampleN  Remarks  Date   Time  Zone
 ------- ------------------------  -------------------------------   -------- ------- -------- ----- ---

   3K-7 CODE NOT GIVEN             KIRKLAND LAKE   RUN 10  1950 HRS.                  03/02/87 19:50 5
                                   RAW WATER                         W07-0054
   3K-8 CODE NOT GIVEN             KIRKLAND LAKE   RUN 10  1950 HRS.                  03/02/87 19:50 5
                                   CLARIFIER                         W07-0055
   3K-9 CODE NOT GIVEN             KIRKLAND LAKE   RUN 10  1950 HRS.                  03/02/87 19:50 5
                                   FILTER                            W07-0056

  3K-11 CODE NOT GIVEN             KIRKLAND LAKE  RUN 11  1500 HRS.                   05/02/87 15:00 5
                                   CLARIFIER                         W07-0057
  3K-12 CODE NOT GIVEN             KIRKLAND LAKE  RUN 11  1500 HRS.                   05/02/87 15:00 5
                                   FILTER                            W07-0058

------------------------------------------------------------------------------------------
    Field Sample Number...        3K-7        3K-8        3K-9                    3K-11       3K-12
Test Description
Code,  Units of Measure         W07-0054    W07-0055    W07-0056                W07-0057    W07-0058
----------------- Method       ----------  ----------  ----------  ----------  ----------  ----------

CONDUCTIVITY 25C                 146.0       151.0       151.0                   153.0       151.0
COND25,UMHO/CM at 25 D.CENT.
                002BI2
HARDNESS, TOTAL                  49.0        48.0        47.0                    49.0        48.5
HARDT ,MG/L as CACO3
                CALC01
CALCIUM, UNF.REACTIVE            13.6        13.7        13.4                    13.9        13.9
CAUR  ,MG/L as Ca (Calcium)
                002AA1
MAGNESIUM, UNF.REACTIVE          3.60        3.35        3.30                    3.55        3.40
MGUR  ,MG/L as Mg  Magnesium
                001AA1
SODIUM, UNF.REACT.               10.7        10.6        10.2                    10.4        10.4
NAUR  ,MG/L as Na (Sodium)
                002BA1
POTASSIUM, UNF.REACT.            .40         .41         .41                     .56         .58
KKUR  ,MG/L as K (Potassium)
                002BA1
ALKALINITY,TOTAL                 38.8        34.8        35.1                    32.9        32.8
ALKT  ,MG/L as CACO3
                004AT6
PH (-LOG(H+(CONCN)))             7.74        7.31        7.39                    7.72        7.66
PH    ,DIMENSIONLESS
                003AI2
CHLORIDE, UNF.REACTIVE           16.70       19.60       19.40                   17.30       17.40
CLIDUR,MG/L as Cl-  Chloride
                004AC1
```

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[illegible] Date  6 MAR 1987, Frame  165, Location E  4, Submission  PC04652

Environment Ontario        PC04652        KIRKLAND LAKE                           Page  11
[illegible]     REPORT                                                   Printed  06/03/87

Sample Class:  W                     Results

WATER (GRND/DOMESTIC) WQ                  Inquiries at: JENIFER McBRIDE
                                            Telephone: 416-235-5875

--------------------------------------------------------------------------------------------
    Field Sample Number...      3K-7        3K-8        3K-9                    3K-11       3K-12
Test Description
Code,  Units of Measure       W07-0054    W07-0055    W07-0056                W07-0057    W07-0058
------------------ Method    ----------- ----------- ----------- ----------- ----------- -----------

SULPHATE, UNF.REACT.           7.85        8.86        8.86                    14.02       14.21
SSO4UR,MG/L as SO4  Sulphate
                    003AI0
TURBIDITY                       .61         .83         .44                     1.01         .36
TURB  ,FORMAZIN TURB. UNITS
                    002AI1
COLOUR, TRUE                   15.0         7.5         7.0                     4.0          4.0
COLTR ,TRUE COLOUR UNITS
                    102BC9
PHOSPHORUS, UNF.TOTAL          .010<T      .020<T      .010<T                  .010<T       .010<T
PPUT  ,MG/L as P  Phosphorus
                    504BC2
NITR'N,TOTAL KJELD,UNF.R        .20<T       .20<T       .20<T                   .30          .20<T
NNTKUR,MG/L as N (Nitrogen)
                    004BC2
AMMONIUM,TOTL, FRAC.REAC        .05<T      <.05<W      <.05<W                  <.05<W       <.05<W
NNHTFR,MG/L as N (Nitrogen)
                    103AC2
NITRATES,TOTL, FRAC.REAC        .15<T       .10<T       .10<T                   .10<T        .10<T
NNOTFR,MG/L as N (Nitrogen)
                    102CC2
NITRITE, FRAC.REACT.           .005<T      .005<T      .005<T                 <.005<W      <.005<W
NNO2FR,MG/L as N (Nitrogen)
                    102CC2
DISSOLVED ORGANIC CARBON        6.3         5.1         4.7                     4.0          3.7
DOC   ,MG/L as C (Carbon)
                    102AC2
```

```
  [illegible]   Date  6 MAR 1987, Frame  165, Location F  4, Submission  PC04652

Environment Ontario           PC04652        KIRKLAND LAKE                          Page  12
FINAL     REPORT                                                             Printed  06/03/87

 Sample Class:  H                            Results

WATER (GRND/DOMESTIC) WQ                          Inquiries at: JENIFER McBRIDE
                                                     Telephone: 416-235-5875

------------------------------------------------------------------------------------------------

 Field                                Sampling Location Description    LAB                   Sampling
 Sample  Sampling Location            Sample Description               Sample#  Remarks   Date     Time Zone
 ------- -------------------------    ------------------------------  -------- -------  -------- ----- ---

   3K-13 CODE NOT GIVEN               KIRKLAND LAKE  RUN 11  2000 HRS.                     05/02/87 20:00 5
                                      FILTER                           W07-0059




------------------------------------------------------------------------------------------------

    Field Sample Number...        3K-13
Test Description
Code,  Units of Measure          W07-0059
----------------- Method     ----------  ----------  ----------  ----------  ----------  ----------

CONDUCTIVITY 25C                  152.0
COND25,UMHO/CM at 25 D.CENT.
                   002BI2
HARDNESS, TOTAL                    48.0
HARDT ,MG/L as CACO3
                   CALC01
CALCIUM, UNF.REACTIVE              13.6
CAUR  ,MG/L as Ca (Calcium)
                   002AA1
MAGNESIUM, UNF.REACTIVE            3.40
MGUR  ,MG/L as Mg  Magnesium
                   001AA1
SODIUM, UNF.REACT.                 10.4
NAUR  ,MG/L as Na (Sodium)
                   002BA1
POTASSIUM, UNF.REACT.               .48
KKUR  ,MG/L as K (Potassium)
                   002BA1
ALKALINITY,TOTAL                   32.2
ALKT  ,MG/L as CACO3
                   004AT6
PH (-LOG(H+(CONCN)))               7.11
PH    ,DIMENSIONLESS
                   003AI2
CHLORIDE, UNF.REACTIVE            17.30
CLIDUR,MG/L as Cl-  Chloride
                   004AC1
```

```
          Date 6 MAR 1987, Frame  165, Location G  4, Submission  PC04652

  Environment Ontario        PC04652        KIRKLAND LAKE                         Page  13
  Lab     REPORT                                                        Printed  06/03/87

 Sample Class:  W                          Results

WATER (GRND/DOMESTIC) WQ                        Inquiries at: JENIFER McBRIDE
                                                  Telephone: 416-235-5875

----------------------------------------------------------------------------------------
    Field Sample Number...       3K-13
Test Description
Code,  Units of Measure         W07-0059
------------------ Method    ----------- ----------- ----------- ----------- ----------- -----------
SULPHATE, UNF.REACT.             14.60
SS04UR,MG/L as SO4  Sulphate
                  003AI0
TURBIDITY                         .42
TURB  ,FORMAZIN TURB. UNITS
                  002AI1
COLOUR, TRUE                      4.0
COLTR ,TRUE COLOUR UNITS
                  102BC9
PHOSPHORUS, UNF.TOTAL            .010<T
PPUT  ,MG/L as P  Phosphorus
                  504BC2
NITR'N,TOTAL KJELD,UNF.R         .20<T
NNTKUR,MG/L as N (Nitrogen)
                  004BC2
AMMONIUM,TOTL, FRAC.REAC        <.05<W
NNHTFR,MG/L as N (Nitrogen)
                  103AC2
NITRATES,TOTL, FRAC.REAC         .10<T
NNOTFR,MG/L as N (Nitrogen)
                  102CC2
NITRITE, FRAC.REACT.             .005<T
NNO2FR,MG/L as N (Nitrogen)
                  102CC2
DISSOLVED ORGANIC CARBON          3.9
DOC   ,MG/L as C (Carbon)
                  102AC2
```

[illegible] Date 6 MAR 1987, Frame 165, Location H 4, Submission PC04652

Environment Ontario PC04652 KIRKLAND LAKE

FINAL REPORT

Printed 06/03/87

Sample Class: ##

Results

DERIVED RESULTS

Inquiries at: WATER QUALITY OFFICE
Telephone: 416-248-3512

Field Sample	Sampling Location	Sampling Location Description Sample Description	LAB Sample#	Remarks	Sampling Date	Time	Zone
3K-1	CODE NOT GIVEN	KIRKLAND LAKE RUN 9 1900 HRS. RAW INFLUENT	ION-CAL		02/02/87	19:00	5
3K-2	CODE NOT GIVEN	1900 HRS. CLARIFIER EFFLUENT	ION-CAL		02/02/87	19:00	5
3K-3	CODE NOT GIVEN	RUN 9 1900 HRS. FILTER EFFLUENT	ION-CAL		02/02/87	19:00	5
3K-4	CODE NOT GIVEN	RUN 10 1650 HRS. RAW WATER	ION-CAL		03/02/87	16:50	5
3K-5	CODE NOT GIVEN	RUN 10 1650 HRS. CLARIFIER	ION-CAL		03/02/87	16:50	5
3K-6	CODE NOT GIVEN	RUN 10 1650 HRS. FILTER	ION-CAL		03/02/87	16:50	5

Field Sample Number... Test Description Code, Units of Measure Method	3K-1 ION-CAL	3K-2 ION-CAL	3K-3 ION-CAL	3K-4 ION-CAL	3K-5 ION-CAL	3K-6 ION-CAL
ION BALANCE CALCULATION CONDTY,UMHO/CM AT 25C	160.8	173.1	189.5	162.9	163.6	161.6
ION BALANCE CALCULATION DISOL ,MG/L	78.09	83.07	91.45	79.02	78.33	77.44
ION BALANCE CALCULATION IONBL ,%	3.324	.7989	2.516	2.499	.1003	.5058

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LIS REPORTS - Date  6 MAR 1987, Frame  165, Location I  4, Submission  PC04652

Environment Ontario          PC04652        KIRKLAND LAKE                                 Page  15
FINAL     REPORT                                                              Printed  06/03/87

Sample Class: ##                         Results

DERIVED RESULTS                                   Inquiries at: WATER QUALITY OFFICE
                                                    Telephone: 416-248-3512

--------------------------------------------------------------------------------------------------
 Field                                Sampling Location Description      LAB                Sampling
 Sample  Sampling Location            Sample Description                 Sample#  Remarks   Date    Time Zone
 ------- ------------------           ----------------------------       -------- -------  -------- ----- ---

   3K-7 CODE NOT GIVEN                KIRKLAND LAKE    RUN 10   1950 HRS.                   03/02/87 19:50 5
                                      RAW WATER                          ION-CAL
   3K-8 CODE NOT GIVEN                KIRKLAND LAKE    RUN 10   1950 HRS.                   03/02/87 19:50 5
                                      CLARIFIER                          ION-CAL
   3K-9 CODE NOT GIVEN                KIRKLAND LAKE    RUN 10   1950 HRS.                   03/02/87 19:50 5
                                      FILTER                             ION-CAL

  3K-11 CODE NOT GIVEN                KIRKLAND LAKE   RUN 11   1500 HRS.                    05/02/87 15:00 5
                                      CLARIFIER                          ION-CAL
  3K-12 CODE NOT GIVEN                KIRKLAND LAKE   RUN 11   1500 HRS.                    05/02/87 15:00 5
                                      FILTER                             ION-CAL

--------------------------------------------------------------------------------------------------
    Field Sample Number...      3K-7        3K-8        3K-9                      3K-11       3K-12
 Test Description
 Code,  Units of Measure      ION-CAL     ION-CAL     ION-CAL                   ION-CAL     ION-CAL
 ----------------- Method    ----------  ----------  ----------  ----------  ----------  ----------

 ION BALANCE CALCULATION     160.2       163.0       160.9                     166.3       166.1
 CONDTY,UMHO/CM AT 25C

 ION BALANCE CALCULATION     77.24       78.18       77.41                     80.24       80.34
 DISOL ,MG/L

 ION BALANCE CALCULATION     2.326       .6386       3.301                     .5185       .6280
 IONBL ,%
```

```
[illegible] Date 6 MAR 1987, Frame  165, Location J  4, Submission  PC04652
Environment Ontario          PC04652       KIRKLAND LAKE
Data    REPORT                                                             Page  16
                                                                   Printed  06/03/87
Sample Class: RB                          Results

DERIVED RESULTS                             Inquiries at: WATER QUALITY OFFICE
                                              Telephone: 416-248-3512

------------------------------------------------------------------------------------------
Field                              Sampling Location Description   LAB                    Sampling
Sample   Sampling Location         Sample Description              Sample#  Remarks   Date    Time  Zone
-------- ------------------- ---------------------------- -------- ------- -------- ----- ---
  3K-13 CODE NOT GIVEN       KIRKLAND LAKE  RUN 11  2000 HRS.                      05/02/87 20:00 5
                             FILTER                          ION-CAL



------------------------------------------------------------------------------------------
    Field Sample Number...       3K-13
Test Description
Code.  Units of Measure        ION-CAL
------------------ Method    ----------- ----------- ----------- ----------- ----------- -----------
ION BALANCE CALCULATION       165.0
CONDTY,UMHO/CM AT 25C

ION BALANCE CALCULATION       79.85
DISOL ,MG/L

ION BALANCE CALCULATION       1.370
IONBL ,%
```

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[illegible]   Date  6 MAR 1987, Frame  165, Location K  4, Submission  PC04652

Environment Ontario            PC04652       KIRKLAND LAKE                               Page  17
[illegible]     REPORT                                                           Printed  06/03/87
        --------------------------------------------------------------------------------------
                                         --------------------------

                              <   ACTUAL RESULT IS LESS THAN THE REPORTED VALUE
                              <T  THIS LOW MEASUREMENT IS TENTATIVE. FOR INFO ONLY
                              <W  "ZERO". VALUE REPORTED IS MIN. MEASURABLE AMOUNT

*** END OF REPORT ***
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LIS REPORTS - Date 11 MAR 1987, Frame  176, Location I 14, Submission  PC04523

Environment Ontario                                                        Page   1
FINAL   REPORT                                                      Printed  11/03/87

Municipality/Project:  K I R K L A N D   L A K E                Submission:  P C 0 4 5 2 3


Sampling Date(s):            F E B  1 1, 1 9 8 7  to  F E B  1 8, 1 9 8 7


  Program.....  0700B01                 WATER  REATMENT RESEARCH  TECHNICAL ADVISORY
  Agency......  01030106

Sampled by:    A.BABB               Date Submitted:  19/02/87,    Date Received:  20/02/87


 ..........  Mail this copy to  ......... Martin, G
                                          WRB:DRINKING WATER
                                          P.O.BOX 213,125 RESOURCES ROAD
                                          REXDALE,ONTARIO
                                          M9W 5L1


 Final reports to  Martin, G            WRB:DRINKING WATER     Telephone: 416-235-5829
-------------------------------------------------------------------------------------------
 Field                                                                       Sampling
 Sample   Sampling Location     Sampling Location Description              Date    Time    Zone
 -------  --------------------  ---------------------------------------  -------  -----    --
   K-1    CODE NOT GIVEN        KIRKLAND LAKE P & R PLANT - RUN 16       11/02/87            5

          Sample Description                        Lab Sample#  Remarks  Lab Sample#  Remarks
          ----------------------------------------  -----------  -------  -----------  -------
          NOT GIVEN                                  W08-0174              W08-0229

          TESTS REQUESTED:  G+RENT01                G+RENT05
                            +LANGI

-------------------------------------------------------------------------------------------
 Field                                                                       Sampling
 Sample   Sampling Location     Sampling Location Description              Date    Time    Zone
 -------  --------------------  ---------------------------------------  -------  -----    --
   K-2    CODE NOT GIVEN        KIRKLAND LK.P&R CLARIFIER-RUN 16-? 1/2 H 11/02/87            5

          Sample Description                        Lab Sample#  Remarks  Lab Sample#  Remarks
          ----------------------------------------  -----------  -------  -----------  -------
          NOT GIVEN                                  W08-0175              W08-0230

          TESTS REQUESTED:  G+RENT01                G+RENT05
                            +LANGI

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[illegible]    Date 11 MAR 1987, Frame  176, Location J 14, Submission  PC04523
                                                                                              Page   2
Environment Ontario          PC04523        KIRKLAND LAKE                          Printed  11/03/87
Final      REPORT
---------------------------------------------------------------------------------------------------------
                                                                                         Sampling
Field                                                                                 Date      Time   Zone
Sample   Sampling Location        Sampling Location Description                      --------  -----   --
------   ---------------------    ------------------------------------------------
   K-3   CODE NOT GIVEN           KIRKLAND LK.P&R-FINAL-RUN 16-2 1/2 HRS.            11/02/87           5

         Sample Description                                  Lab Sample#  Remarks   Lab Sample#  Remarks
         --------------------------------------------------  -----------  --------  -----------  --------
         NOT GIVEN                                            HOB-0176                HOB-0231

         TESTS REQUESTED:  G+REHT01                          G+REHT05
                           +LANGI

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                                                                                         Sampling
Field                                                                                 Date      Time   Zone
Sample   Sampling Location        Sampling Location Description                      --------  ---- -  --
------   ---------------------    ------------------------------------------------
   K-4   CODE NOT GIVEN           KIRKLAND LAKE RUN 18 - 2 1/2 HRS.                  12/02/87           5

         Sample Description                                  Lab Sample#  Remarks   Lab Sample#  Remarks
         --------------------------------------------------  -----------  --------  -----------  --------
         RAW WATER                                            HOB-0177                HOB-0232    !RE

         TESTS REQUESTED:  G+REHT01                          G+REHT05
                           +LANGI

---------------------------------------------------------------------------------------------------------
                                                                                         Sampling
Field                                                                                 Date      Time   Zone
Sample   Sampling Location        Sampling Location Description                      --------  -----   --
------   ---------------------    ------------------------------------------------
   K-5   CODE NOT GIVEN           KIRKLAND LAKE RUN 18 - 3/5 FT. H.L.                12/02/87           5

         Sample Description                                  Lab Sample#  Remarks   Lab Sample#  Remarks
         --------------------------------------------------  -----------  --------  -----------  --------
         RAW WATER                                            HOB-0178                HOB-0233    !RE

         TESTS REQUESTED:  G+REHT01                          G+REHT05
                           +LANGI

---------------------------------------------------------------------------------------------------------
                                                                                         Sampling
Field                                                                                 Date      Time   Zone
Sample   Sampling Location        Sampling Location Description                      --------  -----   --
------   ---------------------    ------------------------------------------------
   K-6   CODE NOT GIVEN           KIRKLAND LAKE 2 1/2 HRS. - 3.5FT. H.L.             12/02/87           5

         Sample Description                                  Lab Sample#  Remarks   Lab Sample#  Remarks
         --------------------------------------------------  -----------  --------  -----------  --------
         FINAL EFFLUENT                                       HOB-0179                HOB-0234

         TESTS REQUESTED:  G+REHT01                          G+REHT05
                           +LANGI

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[illegible] REPORTS - Date 11 MAR 1987, Frame  176, Location K 14, Submission  PC04523

Environment Ontario           PC04523        KIRKLAND LAKE                                     Page   3
[illegible]    REPORT                                                                   Printed  11/03/87

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Field                                                                            Sampling
Sample    Sampling Location      Sampling Location Description              Date     Time    Zone
------    -----------------      ---------------------------------          --------  -----   --
   K-7    CODE NOT GIVEN         KIRKLAND LAKE RUN 19                       13/02/87          5

          Sample Description                       Lab Sample#  Remarks  Lab Sample#  Remarks
          -------------------------------------    -----------  -------  -----------  -------
          RAW WATER                                 W08-0180              W08-0235

          TESTS REQUESTED:  G+RENT01               G+RENT05

---------------------------------------------------------------------------------------------------
Field                                                                            Sampling
Sample    Sampling Location      Sampling Location Description              Date     Time    Zone
--------  -----------------      ---------------------------------          --------  -----   --
   K-8    CODE NOT GIVEN         KIRKLAND LAKE RUN 19 - 22 HOURS            13/02/87          5

          Sample Description                       Lab Sample#  Remarks  Lab Sample#  Remarks
          -------------------------------------    -----------  -------  -----------  -------
          CLARIFIER                                 W08-0181              W08-0236

          TESTS REQUESTED:  G+RENT01               G+RENT05

---------------------------------------------------------------------------------------------------
Field                                                                            Sampling
Sample    Sampling Location      Sampling Location Description              Date     Time    Zone
--------  -----------------      ---------------------------------          --------  -----   --
   K-9    CODE NOT GIVEN         KIRKLAND LAKE 22 HRS. - 2.6 FT. H.L.       13/02/87          5

          Sample Description                       Lab Sample#  Remarks  Lab Sample#  Remarks
          -------------------------------------    -----------  -------  -----------  -------
          FINAL EFFLUENT                            W08-0182              W08-0237

          TESTS REQUESTED:  G+RENT01               G+RENT05
                            +LANGI

---------------------------------------------------------------------------------------------------
Field                                                                            Sampling
Sample    Sampling Location      Sampling Location Description              Date     Time    Zone
--------  -----------------      ---------------------------------          --------  -----   --
  K-10    CODE NOT GIVEN         KIRKLAND LAKE - RUN 22                     16/02/87          5

          Sample Description                       Lab Sample#  Remarks  Lab Sample#  Remarks
          -------------------------------------    -----------  -------  -----------  -------
          RAW WATER                                 W08-0183              W08-0238

          TESTS REQUESTED:  G+RENT01               G+RENT05
                            +LANGI

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[illegible] REPORTS - Date 11 MAR 1987, Frame  176, Location L 14, Submission  PC04523

Environment Ontario          PC04523        KIRKLAND LAKE                                   Page   4
[illegible]     REPORT                                                              Printed  11/03/87

  -------------------------------------------------------------------------------------------------
  Field                                                                          Sampling
  Sample   Sampling Location    Sampling Location Description                 Date     Time   Zone
  -------- -------------------  -------------------------------------------  --------  -----   --
    K-11   CODE NOT GIVEN       KIRKLAND LK-CLARIFIER 2 1/2HRS.0-9FT.H.L     16/02/87           5

           Sample Description                      Lab Sample#  Remarks  Lab Sample#  Remarks
           --------------------------------------  -----------  -------  -----------  -------
           CLARIFIER                                 W08-0184              W08-0239

           TESTS REQUESTED:  G+REWT01                G+REWT05
                             +LANGI

  -------------------------------------------------------------------------------------------------
  Field                                                                          Sampling
  Sample   Sampling Location    Sampling Location Description                 Date     Time   Zone
  -------- -------------------  -------------------------------------------  --------  -----   --
    K-12   CODE NOT GIVEN       KIRKLAND LK-RUN 22-2.5HRS.-0.9 FT.           16/02/87           5

           Sample Description                      Lab Sample#  Remarks  Lab Sample#  Remarks
           --------------------------------------  -----------  -------  -----------  -------
           FINAL EFFLUENT                            W08-0185              W08-0240

           TESTS REQUESTED:  G+REWT01                G+REWT05
                             +LANGI

  -------------------------------------------------------------------------------------------------
  Field                                                                          Sampling
  Sample   Sampling Location    Sampling Location Description                 Date     Time   Zone
  -------- -------------------  -------------------------------------------  --------  -----   --
    K-13   CODE NOT GIVEN       KIRKLAND LK-RUN 23                            18/02/87           5

           Sample Description                      Lab Sample#  Remarks  Lab Sample#  Remarks
           --------------------------------------  -----------  -------  -----------  -------
           RAW WATER                                 W08-0186              W08-0241

           TESTS REQUESTED:  G+REWT01                G+REWT05
                             +LANGI

  -------------------------------------------------------------------------------------------------
  Field                                                                          Sampling
  Sample   Sampling Location    Sampling Location Description                 Date     Time   Zone
  -------- -------------------  -------------------------------------------  --------  -----   --
    K-14   CODE NOT GIVEN       KIRKLAND LK-CLARIFIER-4.5HRS.-1.5FT.H.L.     18/02/87           5

           Sample Description                      Lab Sample#  Remarks  Lab Sample#  Remarks
           --------------------------------------  -----------  -------  -----------  -------
           CLARIFIER                                 W08-0187              W08-0242

           TESTS REQUESTED:  G+REWT01                G+REWT05
                             +LANGI

  -------------------------------------------------------------------------------------------------
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[illegible]  Date 11 MAR 1987, Frame  176, Location M 14, Submission  PC04523

[illegible] Ontario          PC04523        KIRKLAND LAKE                              Page   5
[illegible]     REPORT                                                         Printed  11/03/87

       ------------------------------------------------------------------------------------
 Field                                                                  Sampling
 Sample   Sampling Location      Sampling Location Description        Date     Time   Zone
          ---------------------  ----------------------------------   --------  -----  --
 [illegible]  CODE NOT GIVEN     KIRKLAND LK-RUN 23-4.SHRS.-1.5FT.    18/02/87         5

          Sample Description                 Lab Sample#  Remarks  Lab Sample#  Remarks
          ---------------------------------  -----------  -------  -----------  --------
          FINAL EFFLUENT                     W08-0188              W06-0243

          TESTS REQUESTED:  G+REWT01              G+REWT05
                            +LANGI
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[illegible] Date 11 MAR 1987, Frame  176, Location N 14, Submission  PC04523

Environment Ontario             PC04523        KIRKLAND LAKE                                 Page   6
[illegible]    REPORT                                                              Printed  1 '03/87

Sample Class:  M                                   Results

Metals in Water        IIC                    Inquiries at: Prem Vijan / Pal Lachmaniuk 235-6004
                                                 Telephone: 416-235-5834

------------------------------------------------------------------------------------------------
 Field                                 Sampling Location Description   LAB                 Sampling
 Sample  Sampling Location             Sample Description              Sample#  Remarks   Date    Time Zone
-------- ---------------------------- ---------------------------- --------- ------- -------- ----- ---

     K-1 CODE NOT GIVEN               KIRKLAND LAKE P & R PLANT - RUN 16                  11/02/87        5
                                      NOT GIVEN                       M08-0229
     K-2 CODE NOT GIVEN               KIRKLAND LK.P&R CLARIFIER-RUN 16-2 1/2 H            11/02/87        5
                                      NOT GIVEN                       M08-0230
     K-3 CODE NOT GIVEN               KIRKLAND LK.P&R-FINAL-RUN 16-2 1/2 HRS.             11/02/87        5
                                      NOT GIVEN                       M08-0231



     K-6 CODE NOT GIVEN               KIRKLAND LAKE 2 1.2 HRS. - 3.5FT. H.L.              12/02/87        5
                                      FINAL EFFLUENT                  M08-0234

------------------------------------------------------------------------------------------------
    Field Sample Number...       K-1         K-2         K-3                                  K-6
Test Description
Code,  Units of Measure        M08-0229    M08-0230    M08-0231                             M08-0234
------------------ Method     ----------- ----------- ----------- ----------- ----------- -----------

IRON, UNF.TOTAL                .021        .089        .068                                    !IS
FEUT  ,MG/L as Fe (Iron)                                                                   No Units
                  522AE2                                                                  No Method
MANGANESE, UNF.TOTAL           .021        .018        .017                                    !IS
MNUT  ,MG/L as Mn  Manganese                                                               No Units
                  522AE2                                                                  No Method
ALUMINUM, UNF.TOTAL            .016       1.200        .150                                    !IS
ALUT  ,MG/L as Al (Aluminum)                                                               No Units
                  522AE2                                                                  No Method
ARSENIC, UNF.TOTAL            <.001<      <.001<      <.001<                               <.001<
ASUT  ,MG/L as As (Arsenic)
                  540AF3
COPPER, UNF.TOTAL.             .006        .001        .005                                    !IS
CUUT  ,MG/L as Cu (Copper)                                                                 No Units
                  522AE2                                                                  No Method
LEAD, UNF.TOTAL                .016       <.003<      <.003<                                   !IS
PBUT  ,MG/L as Pb (Lead)                                                                   No Units
                  522AE2                                                                  No Method
ZINC, UNF.TOTAL                .003        .004        .030                                    !IS
ZNUT  ,MG/L as Zn (Zinc)                                                                   No Units
                  522AE2                                                                  No Method
```

LIS REPORTS - Date 11 MAR 1987, Frame 176, Location O 14, Submission PC04523

Environment Ontario PC04523 KIRKLAND LAKE
Final REPORT

Printed 11/03/87

Sample Class: M Results

Metals in Water ITC

Inquiries at: Prem Vijan / Pat Lachmaniuk 235-6004
Telephone: 416-235-5834

Field Sample	Sampling Location	Sampling Location Description Sample Description	LAB Sample#	Remarks	Sampling Date	Time	Zone
K-7	CODE NOT GIVEN	KIRKLAND LAKE RUN 19 RAW WATER	M08-0235		13/02/87		5
K-8	CODE NOT GIVEN	KIRKLAND LAKE RUN 19 - 22 HOURS CLARIFIER	M08-0236		13/02/87		5
K-9	CODE NOT GIVEN	KIRKLAND LAKE 22 HRS. - 2.6 FT. H.L. FINAL EFFLUENT	M08-0237		13/02/87		5
K-10	CODE NOT GIVEN	KIRKLAND LAKE - RUN 22 RAW WATER	M08-0238		16/02/87		5
K-11	CODE NOT GIVEN	KIRKLAND LK-CLARIFIER 2 1/2HRS.0-9FT.H.L CLARIFIER	M08-0239		16/02/87		5
K-12	CODE NOT GIVEN	KIRKLAND LK-RUN 22-2.5HRS.-0.9 FT. FINAL EFFLUENT	M08-0240		16/02/87		5

Field Sample Number ... Test Description Code, Units of Measure Method	K-7 M08-0235	K-8 M08-0236	K-9 M08-0237	K-10 M08-0238	K-11 M08-0239	K-12 M08-0240
IRON, UNF.TOTAL FEUT ,MG/L as Fe (Iron) 522AE2	.020	.160	.190	.020	.130	.031
MANGANESE, UNF.TOTAL MNUT ,MG/L as Mn Manganese 522AE2	.022	.019	.023	.022	.019	.036
ALUMINUM, UNF.TOTAL ALUT ,MG/L as Al (Aluminum) 522AE2	.008	3.700	2.900	.011	3.000	1.100
ARSENIC, UNF.TOTAL ASUT ,MG/L as As (Arsenic) 540AF3	<.001<	<.001<	<.001<	<.001<	<.001<	<.001<
COPPER, UNF.TOTAL. CUUT ,MG/L as Cu (Copper) 522AE2	.002	.001	.012	.002	.001	.026
LEAD, UNF.TOTAL PBUT ,MG/L as Pb (Lead) 522AE2	<.003<	<.003<	<.003<	<.003<	<.003<	.007
ZINC, UNF.TOTAL ZNUT ,MG/L as Zn (Zinc) 522AE2	.002	.007	.045	.006	.009	.028

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[illegible] 11 MAR 1987, Frame 176, Location A 15, Submission PC04523

[illegible]onment Ontario      PC04523        KIRKLAND LAKE                        Page   8
[illegible]    REPORT                                                      Printed 11/03/87

[illegible] ass:  M                               Results

[illegible] Water       LTC                 Inquiries at: Prem Vijan / Pal Lachmaniuk 235-6004
                                              Telephone: 416-235-5834
----------------------------------------------------------------------------------------------
Field                             Sampling Location Description    LAB                  Sampling
Sample  Sampling Location         Sample Description               Sample#  Remarks   Date    Time Zone
--- ---- -------------------      ------------------------------ --------- ------- -------- ----- ---
  K-13 CODE NOT GIVEN             KIRKLAND LK-RUN 23                                 18/02/87        5
                                  RAW WATER                        M08-0241
  K-14 CODE NOT GIVEN             KIRKLAND LK-CLARIFIER-4.5HRS.-1.5FT.H.L.           18/02/87        5
                                  CLARIFIER                        M08-0242
  K-15 CODE NOT GIVEN             KIRKLAND LK-RUN 23-4.5HRS.-1.5FT.                  18/02/87        5
                                  FINAL EFFLUENT                   M08-0243

----------------------------------------------------------------------------------------------
   Field Sample Number...           K-13        K-14        K-15
Test Description
Code.  Units of Measure           M08-0241    M08-0242    M08-0243
----- ------------ Method        ----------- ----------- ----------- ----------- ----------- -----------

IRON, UNF.TOTAL                    .019        .088        .007
FEUT  ,MG/L as Fe (Iron)
                    522AE2
MANGANESE, UNF.TOTAL               .025        .024        .030
MNUT  ,MG/L as Mn  Manganese
                    522AE2
ALUMINUM, UNF.TOTAL                .018       1.600        .034
ALUT  ,MG/L as Al (Aluminum)
                    522AE2
ARSENIC, UNF.TOTAL               <.001<      <.001<      <.001<
AGUT  ,MG/L as As (Arsenic)
                    540AF3
COPPER, UNF.TOTAL.                 .002        .001        .011
CUUT  ,MG/L as Cu (Copper)
                    522AE2
LEAD, UNF.TOTAL                  <.003<        .003      <.003<
PBUT  ,MG/L as Pb (Lead)
                    522AE2
ZINC, UNF.TOTAL                    .013        .006        .010
ZNUT  ,MG/L as Zn (Zinc)
                    522AE2
```

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. REPORTS  Date 11 MAR 1987, Frame  176, Location B 15, Submission  PC04523

Environment Ontario          PC04523        KIRKLAND LAKE                            Page   9
Final    REPORT                                                             Printed  11/03/87

 Sample Class:  W                             Results

WATER (GRND/DOMESTIC) WQ                          Inquiries at: JENIFER McBRIDE
                                                    Telephone: 416-235-5875

 ---------------------------------------------------------------------------------------------------
 Field                                Sampling Location Description  LAB                  Sampling
 Sample  Sampling Location            Sample Description             Sample#  Remarks   Date   Time Zone
 -------- -------------------- ------------------------------ -------- -------- -------- ----- ---

     K-1 CODE NOT GIVEN       KIRKLAND LAKE P & R PLANT - RUN 16                      11/02/87        5
                              NOT GIVEN                       W08-0174
     K-2 CODE NOT GIVEN       KIRKLAND LK.P&R CLARIFIER-RUN 16-2 1/2 H                11/02/87        5
                              NOT GIVEN                       W08-0175
     K-3 CODE NOT GIVEN       KIRKLAND LK.P&R-FINAL-RUN 16-2 1/2 HRS.                 11/02/87        5
                              NOT GIVEN                       W08-0176
     K-4 CODE NOT GIVEN       KIRKLAND LAKE RUN 18 - 2 1/2 HRS.                       12/02/87        5
                              RAW WATER                       W08-0177
     K-5 CODE NOT GIVEN       KIRKLAND LAKE RUN 18 - 3/5 FT. H.L.                     12/02/87        5
                              RAW WATER                       W08-0178
     K-6 CODE NOT GIVEN       KIRKLAND LAKE 2 1/2 HRS. - 3.5FT. H.L.                  12/02/87        5
                              FINAL EFFLUENT                  W08-0179

 ---------------------------------------------------------------------------------------------------
    Field Sample Number...         K-1         K-2         K-3         K-4         K-5         K-6
 Test Description
 Code,  Units of Measure        W08-0174    W08-0175    W08-0176    W08-0177    W08-0178    W08-0179
 ----------------- Method    ----------- ----------- ----------- ----------- ----------- -----------

 CONDUCTIVITY 25C               150.0       159.0       159.0       148.0       160.0       160.0
 COND25,UMHO/CM at 25 D.CENT.
                  002BI2
 HARDNESS, TOTAL                 50.5        49.6        49.0        49.0        49.0        49.0
 HARDT ,MG/L as CACO3
                   CALC01
 CALCIUM, UNF.REACTIVE           14.4        14.2        14.0        14.0        13.8        13.9
 CAUR  ,MG/L as Ca (Calcium)
                  002AA1
 MAGNESIUM, UNF.REACTIVE         3.50        3.40        3.40        3.40        3.50        3.45
 MGUR  ,MG/L as Mg  Magnesium
                  001AA1
 SODIUM, UNF.REACT.              11.3        10.7        10.5        11.3        10.7        10.5
 NAUR  ,MG/L as Na (Sodium)
                  002BA1
 POTASSIUM, UNF.REACT.            .39         .37         .34         .39         .32         .37
 KKUR  ,MG/L as K (Potassium)
                  002BA1
 ALKALINITY,TOTAL                39.6        23.1        24.2        39.4        21.2        21.0
 ALKT  ,MG/L as CACO3
                  004AT6
 PH (-LOG(H+(CONCN)))            7.57        6.96        7.19        7.50        6.79        6.84
 PH    ,DIMENSIONLESS
                  003AI2
 CHLORIDE, UNF.REACTIVE         16.90       16.80       16.50       16.80       16.90       17.00
 CLIDUR,MG/L as Cl-  Chloride
                  004AC1
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Sample Class: W Results

WATER (GRND/DOMESTIC) WQ

Inquiries at: JENIFER McBRIDE
Telephone: 416-235-5875

Field Sample Number ... Test Description Code, Units of Measure Method	K-1 W08-0174	K-2 W08-0175	K-3 W08-0176	K-4 W08-0177	K-5 W08-0178	K-6 W08-0179
SULPHATE, UNF.REACT. SSO4UR,MG/L as SO4 Sulphate 003AI0	11.16	24.04	23.44	12.09	27.27	27.96
TURBIDITY TURB ,FORMAZIN TURB. UNITS 002AI1	.40	2.10	.30	.30	1.60	.41
COLOUR, TRUE COLTR ,TRUE COLOUR UNITS 102BC9	16.0	2.0<T	5.0	15.5	2.5<T	4.5
PHOSPHORUS, UNF.TOTAL PPUT ,MG/L as P Phosphorus 504BC2	<.010<W	<.010<W	<.010<W	.060	.030<T	.020<T
NITR'N,TOTAL KJELD,UNF.R NNTKUR,MG/L as N (Nitrogen) 004BC2	.10<T	<.05<W	<.05<W	.50	.40	.30
AMMONIUM,TOTL, FRAC.REAC NNHTFR,MG/L as N (Nitrogen) 103AC2	<.05<W	<.05<W	<.05<W	<.05<W	<.05<W	<.05<W
NITRATES,TOTL, FRAC.REAC NNOTFR,MG/L as N (Nitrogen) 102CC2	<.05<W	<.05<W	<.05<W	<.05<W	<.05<W	<.05<W
NITRITE, FRAC.REACT. NNO2FR,MG/L as N (Nitrogen) 102CC2	<.005<W	<.005<W	<.005<W	<.005<W	<.005<W	<.005<W
DISSOLVED ORGANIC CARBON DOC ,MG/L as C (Carbon) 102AC2	5.7	3.7	3.1	5.7	3.0	2.8
ARSENIC, UNF.TOTAL AGUT ,MG/L as As (Arsenic) 540AF3				<.001<	<.001<	
LANGELIER'S INDEX LANGI ,DIMENSIONLESS CALC01	-.93	-1.78	-1.54	-1.02	-2.01	-1.96

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Results

[illegible]

Inquiries at: JENIFER McBRIDE
Telephone: 416-235-5875

Field Sample	Sampling Location	Sampling Location Description Sample Description	LAB Sample#	Remarks	Sampling Date	Time	Zone
K-7	CODE NOT GIVEN	KIRKLAND LAKE RUN 19 RAW WATER	W08-0180		13/02/87		5
K-8	CODE NOT GIVEN	KIRKLAND LAKE RUN 19 - 22 HOURS CLARIFIER	W08-0181		13/02/87		5
K-9	CODE NOT GIVEN	KIRKLAND LAKE 22 HRS. - 2.6 FT. H.L. FINAL EFFLUENT	W08-0182		13/02/87		5
K-10	CODE NOT GIVEN	KIRKLAND LAKE - RUN 22 RAW WATER	W08-0183		16/02/87		5
K-11	CODE NOT GIVEN	KIRKLAND LK-CLARIFIER 2 1/2HRS.0-9FT.H.L CLARIFIER	W08-0184		16/02/87		5
K-12	CODE NOT GIVEN	KIRKLAND LK-RUN 22-2.5HRS.-0.9 FT. FINAL EFFLUENT	W08-0185		16/02/87		5

Field Sample Number ... Test Description Code, Units of Measure Method	K-7 W08-0180	K-8 W08-0181	K-9 W08-0182	K-10 W08-0183	K-11 W08-0184	K-12 W08-0185
CONDUCTIVITY 25C COND25,UMHO/CM at 25 D.CENT. 002BI2	150.0	172.0	171.0	149.0	168.0	168.0
HARDNESS, TOTAL HARDT ,MG/L as CACO3 CALC01	49.0	49.5	49.5	48.0	49.0	48.5
CALCIUM, UNF.REACTIVE CAUR ,MG/L as Ca (Calcium) 002AA1	13.9	14.2	14.0	13.8	14.3	14.0
MAGNESIUM, UNF.REACTIVE MGUR ,MG/L as Mg Magnesium 001AA1	3.40	3.40	3.50	3.25	3.30	3.35
SODIUM, UNF.REACT. NAUR ,MG/L as Na (Sodium) 002BA1	10.7	10.7	11.2	10.8	10.9	11.0
POTASSIUM, UNF.REACT. KKUR ,MG/L as K (Potassium) 002BA1	.37	.41	.43	.33	.35	.55
ALKALINITY,TOTAL ALKT ,MG/L as CACO3 004AT6	40.4	3.9	4.6	39.9	9.7	10.9
PH (-LOG(H+(CONCN))) PH ,DIMENSIONLESS 003AI2	7.65	6.78	6.09	7.59	6.40	6.54
CHLORIDE, UNF.REACTIVE CLIDUR,MG/L as Cl- Chloride 004AC1	17.60	17.20	17.20	17.30	16.90	16.80

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Sample Class: W Results

WATER (GRND/DOMESTIC) WQ

Inquiries at: JENIFER McBRIDE
Telephone: 416-235-5875

Field Sample Number ... Test Description Code, Units of Measure Method	K-7 W08-0180	K-8 W08-0181	K-9 W08-0182	K-10 W08-0183	K-11 W08-0184	K-12 W08-0185
SULPHATE, UNF.REACT. SSO4UR,MG/L as SO4 Sulphate 003AI0	11.12	45.82	44.60	11.12	39.73	38.68
TURBIDITY TURB ,FORMAZIN TURB. UNITS 002AI1	.36	.39	3.30	.40	3.10	1.30
COLOUR, TRUE COLTR ,TRUE COLOUR UNITS 102BC9	16.0	3.0	2.5<T	14.5	1.5<T	2.5<T
PHOSPHORUS, UNF.TOTAL PPUT ,MG/L as P Phosphorus 504BC2	.030<T	.020<T	.020<T	.020<T	.020<T	.020<T
NITR'N,TOTAL KJELD,UNF.R NNTKUR,MG/L as N (Nitrogen) 004BC2	.40	.30	.30	.40	.30	.20<T
AMMONIUM,TOTL, FRAC.REAC NNHTFR,MG/L as N (Nitrogen) 103AC2	<.05<W	<.05<W	<.05<W	<.05<W	.05<T	.05<T
NITRATES,TOTL, FRAC.REAC NNOTFR,MG/L as N (Nitrogen) 102CC2	<.05<W	<.05<W	<.05<W	.05<T	.05<T	.10<T
NITRITE, FRAC.REACT. NNO2FR,MG/L as N (Nitrogen) 102CC2	<.005<W	<.005<W	<.005<W	<.005<W	<.005<W	<.005<W
DISSOLVED ORGANIC CARBON DOC ,MG/L as C (Carbon) 102AC2	6.7	2.4	2.4	5.6	2.4	2.3
ARSENIC, UNF.TOTAL AGUT						
LANGELIER'S INDEX LANGI ,DIMENSIONLESS CALC01			-3.37	-.93	-2.72	-2.54

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 I  REPORTS   Date 11 MAR 1987, Frame  176, Location F 15, Submission  PC04523

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Sample Class:  W                              Results

WATER (GRND/DOMESTIC) WQ                     Inquiries at: JENIFER McBRIDE
                                                Telephone: 416-235-5075

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

 Field                                 Sampling Location Description    LAB                    Sampling
 Sample   Sampling Location           Sample Description               Sample#  Remarks   Date   Time Zone
 -------- ------------------          ---------------------------      -------- -------   -------- ----- ---

    K-13 CODE NOT GIVEN              KIRKLAND LK-RUN 23                                   18/02/87        5
                                      RAW WATER                         W08-0186
    K-14 CODE NOT GIVEN              KIRKLAND LK-CLARIFIER-4.5HRS.-1.5FT.H.L.            18/02/87        5
                                      CLARIFIER                         W08-0187
    K-15 CODE NOT GIVEN              KIRKLAND LK-RUN 23-4.5HRS.-1.5FT.                   18/02/87        5
                                      FINAL EFFLUENT                    W08-0188



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     Field Sample Number ...        K-13        K-14        K-15
 Test Description
 Code,  Units of Measure          W08-0186    W08-0187    W08-0188
 ----------------- Method        ----------  ----------  ----------  ----------  ----------  ----------

 CONDUCTIVITY 25C                  149.0       160.0       159.0
 COND25,UMHO/CM at 25 D.CENT.
                       002BI2
 HARDNESS, TOTAL                    48.0        49.0        49.0
 HARDT ,MG/L as CACO3
                       CALC01
 CALCIUM, UNF.REACTIVE              13.9        14.1        14.0
 CAUR  ,MG/L as Ca (Calcium)
                       002AA1
 MAGNESIUM, UNF.REACTIVE            3.25        3.30        3.35
 MGUR  ,MG/L as Mg  Magnesium
                       001AA1
 SODIUM, UNF.REACT.                 10.5        10.7        10.3
 NAUR  ,MG/L as Na (Sodium)
                       002BA1
 POTASSIUM, UNF.REACT.              .35         .32         .34
 KKUR  ,MG/L as K (Potassium)
                       002BA1
 ALKALINITY,TOTAL                   39.6        25.3        25.3
 ALKT  ,MG/L as CACO3
                       004AT6
 PH (-LOG(H+(CONCN)))               7.60        7.03        7.34
 PH    ,DIMENSIONLESS
                       003AI2
 CHLORIDE, UNF.REACTIVE            17.00       17.20       17.40
 CLIDUR ,MG/L as Cl-  Chloride
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[illegible]   Date 11 MAR 1987, Frame  176, Location G 15, Submission  PC04523
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[illegible]   REPORT                                                         Printed  11/03/87

Sample Class:  N                           Results

WATER (GRND/DOMESTIC) WQ                         Inquiries at: JENIFER McBRIDE
                                                   Telephone: 416-235-5875
        ------------------------------------------------------------------------------------------
      Field Sample Number ...      K-13        K-14        K-15
Test Description
Code,  Units of Measure          W08-0186    W08-0187    W08-0188
------------------ Method       ----------- ----------- ----------- ----------- ----------- ----------

SULPHATE, UNF.REACT.              11.12       24.32       24.00
SSO4UR,MG/L as SO4  Sulphate
                   003AI0
TURBIDITY                          .50        2.00         .14
TURB  ,FORMAZIN TURB. UNITS
                   002AI1
COLOUR, TRUE                      161.0        5.0         3.5
COLTR ,TRUE COLOUR UNITS
                   102BC9
PHOSPHORUS, UNF.TOTAL             .0[illegible]0<T      .020<T      .040<T
PPUT  ,MG/L as P  Phosphorus
                   504BC2
NITR'N,TOTAL KJELD,UNF.R           .30         .30         .40
NNTKUR,MG/L as N (Nitrogen)
                   004BC2
AMMONIUM,TOTL, FRAC.REAC          .10<T       .10<T       .05<T
NNHTFR,MG/L as N (Nitrogen)
                   103AC2
NITRATES,TOTL, FRAC.REAC          .15<T       .15<T       .10<T
NNOTFR,MG/L as N (Nitrogen)
                   102CC2
NITRITE, FRAC.REACT.              .005<T      .005<T      .005<T
NNO2FR,MG/L as N (Nitrogen)
                   102CC2
DISSOLVED ORGANIC CARBON           5.7         3.5         3.2
DOC   ,MG/L as C (Carbon)
                   102AC2
ARSENIC, UNF.TOTAL
ASUT

LANGELIER'S INDEX                 -.92       -1.68       -1.37
LANGI ,DIMENSIONLESS
                   CALC01
```

[illegible] Date 11 MAR 1987, Frame 176, Location H 15, Submission PC04523

[illegible]ment Ontario PC04523 KIRKLAND LAKE Page 15
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[illegible] Class: 88 Results

DERIVED RESULTS

Inquiries at: WATER QUALITY OFFICE
Telephone: 416-248-3512

Field Sample	Sampling Location	Sampling Location Description Sample Description	LAt Sample#	Remarks	Sampling Date	Sampling Time	Zone
K-1	CODE NOT GIVEN	KIRKLAND LAKE P & R PLANT - RUN 16 NOT GIVEN	ION-CAL		11/02/87		5
K-2	CODE NOT GIVEN	KIRKLAND LK.P&R CLARIFIER RUN 16-2 1/2 H NOT GIVEN	ION-CAL		11/02/87		5
K-3	CODE NOT GIVEN	KIRKLAND LK.P&R-FINAL-RUN 16-2 1/2 HRS. NOT GIVEN	ION-CAL		11/02/87		5
K-4	CODE NOT GIVEN	KIRKLAND LAKE RUN 18 - 2 1/2 HRS. RAW WATER	ION-CAL		12/02/87		5
K-5	CODE NOT GIVEN	KIRKLAND LAKE RUN 18 - 3/5 FT. H.L. RAW WATER	ION-CAL		12/02/87		5
K-6	CODE NOT GIVEN	KIRKLAND LAKE 2 1/2 HRS. - 3.5FT. H.L. FINAL EFFLUENT	ION-CAL		12/02/87		5

Field Sample Number ... Test Description Code, Units of Measure Method	K-1 ION-CAL	K-2 ION-CAL	K-3 ION-CAL	K-4 ION-CAL	K-5 ION-CAL	K-6 ION-CAL
ION BALANCE CALCULATION CONDTY,UMHO/CM AT 25C	166.7	173.0	171.4	168.2	176.0	176.9
ION BALANCE CALCULATION DIGOL ,MG/L	81.80	83.59	82.94	81.99	85.41	85.98
ION BALANCE CALCULATION IONBL ,%	.4916	1.899	.4657	2.268	1.225	2.599

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[illegible]   [illegible] 11 MAR 198[illegible]  Frame  176, Location I 15, Submission  PC04523

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[illegible]mple [illegible]lass: RR                       Results

DERIVED RESULTS                              Inquiries at: WATER QUALITY OFFICE
                                               Telephone: 416-248-3512

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Field                         Sampling Location Description      LAB                     Sampling
Sample  Sam[illegible]ing Location  Sample Description      Sample#   Remarks    Date    Time Zone
-------- --------  ---------  ------------------------------ -------- -------  --------  ----- ---

    K-7 CODE NOT GIVEN        KIRKLAND LAKE RUN 19                                   13/02/87        5
                              RAW WATER                          ION-CAL
    K-8 CODE NOT GIVEN        KIRKLAND LAKE RUN 19 - 22 HOURS                        13/02/87        5
                              CLARIFIER                          ION-CAL
    K-9 CODE NOT GIVEN        KIRKLAND LAKE 22 HRS. - 2.6 FT. H.L.                   13/02/87        5
                              FINAL EFFLUENT                     ION-CAL
   K-10 CODE NOT GIVEN        KIRKLAND LAKE - RUN 22                                 16/02/87        5
                              RAW WATER                          ION-CAL
   K-11 CODE NOT GIVEN        KIRKLAND LK-CLARIFIER 2 1/2HRS.0-9FT.H.L               16/02/87        5
                              CLARIFIER                          ION-CAL
   K-12 CODE NOT GIVEN        KIRKLAND LK-RUN 22-2.5HRS.-0.9 FT.                     16/02/87        5
                              FINAL EFFLUENT                     ION-CAL

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   Field Sample Number...       K-7        K-8        K-9        K-10       K-11       K-12
Test Description
Code,  Units of Measure       ION-CAL    ION-CAL    ION-CAL    ION-CAL    ION-CAL    ION-CAL
----------------- Method    ---------- ---------- ---------- ---------- ---------- ----------

ION BALANCE CALCULATION       167.6      192.7      192.0      166.0      187.7      187.0
CONDTY,UMHO/CM AT 25C

ION BALANCE CALCULATION       81.72      94.11      93.74      81.15      91.68      91.53
DISOL ,MG/L

ION BALANCE CALCULATION       6.027      3.491      1.353      6.027      1.981      2.280
IONBL ,%
```

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[illegible]   Date 11 MAR 1987, Frame  176, Location J 15, Submission  PC04523

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Sample Class: ##                          Results

DERIVED RESULTS                                  Inquiries at: WATER QUALITY OFFICE
                                                   Telephone: 416-248-3512

     ---------------------------------------------------------------------------------------------
Field                               Sampling Location Description    LAB                    Sampling
Sample  Sampling Location           Sample Description               Sample#  Remarks   Date    Time Zone
-------- ------------------------   ------------------------------   -------- -------   -------- ----- ---

   K-13 CODE NOT GIVEN              KIRKLAND LK-RUN 23                                  18/02/87        5
                                    RAW WATER                        ION-CAL
   K-14 CODE NOT GIVEN              KIRKLAND LK-CLARIFIER-4.5HRS.-1.5FT.H.L.            18/02/87        5
                                    CLARIFIER                        ION-CAL
   K-15 CODE NOT GIVEN              KIRKLAND LK-RUN 23-4.5HRS.-1.5FT.                   18/02/87        5
                                    FINAL EFFLUENT                   ION-CAL



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    Field Sample Number ...       K-13       K-14       K-15
Test Description
Code,  Units of Measure         ION-CAL    ION-CAL    ION-CAL
------------------ Method     ---------- ---------- ---------- ---------- ---------- ----------

ION BALANCE CALCULATION        165.9      176.7      175.2
CONDTY,UMHO/CM AT 25C

ION BALANCE CALCULATION        81.06      86.16      85.32
DISOL ,MG/L

ION BALANCE CALCULATION        5.548      3.564      4.796
IONBL ,%
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REPORTS - Date 11 MAR 1987, Frame  176, Location K 15, Submission  PC04523

ment Ontario              PC04523        KIRKLAND LAKE                        Page  18
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Sample Class: NS                        Results

* No Suitable Sample *                        Inquiries at: WATER QUALITY OFFICE
                                                 Telephone:
---------------------------------------------------------------------------------------
Field                           Sampling Location Description     LAB                  Sampling
Sample   Sampling Location      Sample Description                Sample#  Remarks    Date   Time Zone
-------- ---------------------- ------------------------------ --------- ------- -------- ----- ---



    K-4 CODE NOT GIVEN          KIRKLAND LAKE RUN 18 - 2 1/2 HRS.                     12/02/87        5
                                RAW WATER                        NSS -
    K-5 CODE NOT GIVEN          KIRKLAND LAKE RUN 18 - 3/5 FT. H.L.                   12/02/87        5
                                RAW WATER                        NSS -

---------------------------------------------------------------------------------------
                                                                    K-4        K-5
   Field Sample Number...
Test Description                                                 NSS -      NSS -
Code,  Units of Measure
------------------ Method  ---------- ---------- ---------- ---------- ---------- ----------
                                                                    NSS        NSS
IRON, UNF.TOTAL
FEUT  ,No Units available
                                                                    NSS        NSS
MANGANESE, UNF.TOTAL
MNUT  ,No Units available
                                                                    NSS        NSS
ALUMINUM, UNF.TOTAL
ALUT  ,No Units available
                                                                    NSS        NSS
COPPER, UNF.TOTAL.
CUUT  ,No Units available
                                                                    NSS        NSS
LEAD, UNF.TOTAL
PBUT  ,No Units available
                                                                    NSS        NSS
ZINC, UNF.TOTAL
ZNUT  ,No Units available
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                    --------------------------
                    !IS NO DATA: INSUFFICIENT SAMPLE.
                    !RE NO DATA: SAMPLE CONTAINER RECEIVED EMPTY.
                    <   ACTUAL RESULT IS LESS THAN THE REPORTED VALUE
                    <T  THIS LOW MEASUREMENT IS TENTATIVE. FOR INFO ONLY
                    <W  "ZERO". VALUE REPORTED IS MIN. MEASURABLE AMOUNT
                    NSS NO SUITABLE SAMPLE
*** END OF REPORT ***
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LIS REPORTS - Date 25 MAR 1987, Frame  211, Location L  8, Submission  PC04525

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Municipality/Project:   KIRKLAND  LAKE                           Submission:   PC04525


Sampling Date(s):              FEB 24,1987 to  FEB 27,1987


  Program.....  0700801                   WATER TREATMENT RESEARCH  TECHNICAL ADVISORY
  Agency......  01030106

Sampled by:     A.BUDD                    Date Submitted:  03/03/87.    Date Received:  03/03/87


  ..........  Mail this copy to  .........  Martin, G
                                             WRB:DRINKING WATER
                                             P.O.BOX 213,125 RESOURCES ROAD
                                             REXDALE,ONTARIO
                                             M9W 5L1


 Final reports to  Martin, G              WRB:DRINKING WATER    Telephone: 416-235-5829
-------------------------------------------------------------------------------------------
 Field                                                                         Sampling
 Sample    Sampling Location        Sampling Location Description           Date    Time   Zone
 -------   ---------------------    ------------------------------------    ------- -----  --
     K-1   CODE NOT GIVEN           KIRKLAND LAKE                           24/02/87       5

           Sample Description                           Lab Sample#  Remarks  Lab Sample#  Remarks
           ------------------------------------------   -----------  -------  -----------  -------
           RAW WATER - RUN 27                             W10-0058              W10-0069

           TESTS REQUESTED:  G+REWT01                   G+REWT05
                             +LANGI

-------------------------------------------------------------------------------------------
 Field                                                                         Sampling
 Sample    Sampling Location        Sampling Location Description           Date    Time   Zone
 -------   ---------------------    ------------------------------------    ------- -----  --
     K-2   CODE NOT GIVEN           KIRKLAND LAKE CLARIFIER 1.5HRS.H.L.O.4FT  24/02/87     5

           Sample Description                           Lab Sample#  Remarks  Lab Sample#  Remarks
           ------------------------------------------   -----------  -------  -----------  -------
           CLARIFIER                                      W10-0059              W10-0070

           TESTS REQUESTED:  G+REWT01                   G+REWT05
                             +LANGI

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[illegible]   Date 25 MAR 1987, Frame  211, Location M  8, Submission  PC04525

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 Field                                                                               Sampling
 Sample   Sampling Location    Sampling Location Description                   Date     Time   Zone
 --------  -------------------  ----------------------------------------------  ---------  -----   --
      K-3  CODE NOT GIVEN       KIRKLAND LAKE                                    24/02/87          5

          Sample Description                       Lab Sample#  Remarks  Lab Sample#  Remarks
          ----------------------------------------  -----------  --------  -----------  --------
          FINAL EFFLUENT                             M10-0060               M10-0071

          TESTS REQUESTED:  G+REMT01             G+REMT05
                            +LANGI
 ---------------------------------------------------------------------------------------------------
 Field                                                                               Sampling
 Sample   Sampling Location    Sampling Location Description                   Date     Time   Zone
 --------  -------------------  ----------------------------------------------  ---------  -----   --
      K-4  CODE NOT GIVEN       KIRKLAND LAKE                                    26/02/87          5

          Sample Description                       Lab Sample#  Remarks  Lab Sample#  Remarks
          ----------------------------------------  -----------  --------  -----------  --------
          RAW WATER - RUN 29                         M10-0061               M10-0072

          TESTS REQUESTED:  G+REMT01             G+REMT05
                            +LANGI
 ---------------------------------------------------------------------------------------------------
 Field                                                                               Sampling
 Sample   Sampling Location    Sampling Location Description                   Date     Time   Zone
 --------  -------------------  ----------------------------------------------  ---------  -----   --
      K-5  CODE NOT GIVEN       KIRKLAND LAKE                                    26/02/87          5

          Sample Description                       Lab Sample#  Remarks  Lab Sample#  Remarks
          ----------------------------------------  -----------  --------  -----------  --------
          CLARIFIER - 2HRS.-0.6FT. M.L.              M10-0062               M10-0073

          TESTS REQUESTED:  G+REMT01             G+REMT05
                            +LANGI
 ---------------------------------------------------------------------------------------------------
 Field                                                                               Sampling
 Sample   Sampling Location    Sampling Location Description                   Date     Time   Zone
 --------  -------------------  ----------------------------------------------  ---------  -----   --
      K-6  CODE NOT GIVEN       KIRKLAND LAKE                                    26/02/87          5

          Sample Description                       Lab Sample#  Remarks  Lab Sample#  Remarks
          ----------------------------------------  -----------  --------  -----------  --------
          FINAL EFFLUENT                             M10-0063               M10-0074

          TESTS REQUESTED:  G+REMT01             G+REMT05
                            +LANGI

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  [illegible]  Date 25 MAR 1987, Frame  211, Location N  8, Submission  PC04525

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        -------------------------------------------------------------------------------------------
Field                                                                                Sampling
Sample    Sampling Location      Sampling Location Description                  Date     Time    Zone
-------   -------------------   --------------------------------------------   --------  -----    --
    K-7   CODE NOT GIVEN        KIRKLAND LAKE                                  27/02/87           5

          Sample Description                                 Lab Sample#  Remarks  Lab Sample#  Remarks
          -----------------------------------------------   -----------  -------  -----------  -------
          RAW WATER - RUN 30                                   M10-0064             M10-0075

          TESTS REQUESTED:  G+REMT01                        G+REMT05
                            +LANGI

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Field                                                                                Sampling
Sample    Sampling Location      Sampling Location Description                  Date     Time    Zone
-------   -------------------   --------------------------------------------   --------  -----    --
    K-8   CODE NOT GIVEN        CLARIFIER -4.7 HRS.-1.5FT. H.L.                27/02/87           5

          Sample Description                                 Lab Sample#  Remarks  Lab Sample#  Remarks
          -----------------------------------------------   -----------  -------  -----------  -------
          NOT GIVEN                                            M10-0065             M10-0076

          TESTS REQUESTED:  G+REMT01                        G+REMT05
                            +LANGI

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Field                                                                                Sampling
Sample    Sampling Location      Sampling Location Description                  Date     Time    Zone
-------   -------------------   --------------------------------------------   --------  -----    --
    K-9   CODE NOT GIVEN        KIRKLAND LAKE                                  27/02/87           5

          Sample Description                                 Lab Sample#  Remarks  Lab Sample#  Remarks
          -----------------------------------------------   -----------  -------  -----------  -------
          FINAL EFFLUENT                                       M10-0066             M10-0077

          TESTS REQUESTED:  G+REMT01                        G+REMT05
                            +LANGI

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LIS REPORTS   Date 25 MAR 1987, Frame  211, Location 0  8, Submission  PC04525

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LIMS     REPORT                                                              Printed  25/03/87

Sample Class:  M                       Results

Metals in Water        ITC                    Inquiries at: Prem Vijan / Pat Lachmaniuk 235-6004
                                                 Telephone: 416-235-5834

--------------------------------------------------------------------------------------------------
 Field                                Sampling Location Description    LAB                    Sampling
 Sample  Sampling Location            Sample Description               Sample#  Remarks  Date     Time Zone
 ------- -----------------            -------------------------------- -------- ------- -------- ---- ---
     K-1 CODE NOT GIVEN               KIRKLAND LAKE                                      24/02/87       5
                                      RAW WATER - RUN 27               M10-0069
     K-2 CODE NOT GIVEN               KIRKLAND LAKE CLARIFIER 1.5HRS.H.L.0.4FT           24/02/87       5
                                      CLARIFIER                        M10-0070
     K-3 CODE NOT GIVEN               KIRKLAND LAKE                                      24/02/87       5
                                      FINAL EFFLUENT                   M10-0071
     K-4 CODE NOT GIVEN               KIRKLAND LAKE                                      26/02/87       5
                                      RAW WATER - RUN 29               M10-0072
     K-5 CODE NOT GIVEN               KIRKLAND LAKE                                      26/02/87       5
                                      CLARIFIER - 2HRS.-0.6FT. H.L.    M10-0073
     K-6 CODE NOT GIVEN               KIRKLAND LAKE                                      26/02/87       5
                                      FINAL EFFLUENT                   M10-0074

--------------------------------------------------------------------------------------------------
    Field Sample Number...         K-1        K-2        K-3        K-4        K-5        K-6
 Test Description
 Code,  Units of Measure        M10-0069   M10-0070   M10-0071   M10-0072   M10-0073   M10-0074
 ------------------- Method     --------   --------   --------   --------   --------   --------
 IRON, UNF.TOTAL
 FEUT  ,MG/L as Fe (Iron)         .032       .090       .015       .044       .130       .060
                    522AE2
 MANGANESE, UNF.TOTAL
 MNUT  ,MG/L as Mn  Manganese     .032       .033       .033       .050       .028       .029
                    522AE2
 ALUMINUM, UNF.TOTAL
 ALUT   MG/L as Al (Aluminum)     .019      2.300       .190       .017      1.300       .120
                    522AE2
 ARSENIC, UNF. OTAL
 ASUT  ,MG/L as As (Arsenic)     <.001<     <.001<     <.001<     <.001<     <.001<     <.001<
                    540AF3
 COPPER, UNF.TOTAL.
 CUUT  ,MG/L as Cu (Copper)       .003       .001       .009       .015       .001       .009
                    522AE2
 LEAD, UNF.TOTAL
 PBUT  ,MG/L as Pb (Lead)        <.003<     <.003<      .005       .004      <.003<      .004
                    522AE2
 ZINC, UNF.TOTAL
 ZNUT  ,MG/L as Zn (Zinc)         .003       .005       .034       .009       .006       .042
                    522AE2
```

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Sample Class:  M                         Results

Metals in Water       ITC                     Inquiries at: Prem Vijan / Pat Lachmaniuk 235-6004
                                                Telephone: 416-235-5834

------------------------------------------------------------------------------------------------
 Field                               Sampling Location Description   LAB                  Sampling
 Sample  Sampling Location           Sample Description              Sample#  Remarks  Date   Time Zone
 -------- ------------------ ------------------------------ -------- ------- -------- ----- ---
    K-7 CODE NOT GIVEN       KIRKLAND LAKE                                    27/02/87       5
                             RAW WATER - RUN 30              M10-0075
    K-8 CODE NOT GIVEN       CLARIFIER -4.7 HRS.-1.5FT. H.L.                  27/02/87       5
                             NOT GIVEN                       M10-0076
    K-9 CODE NOT GIVEN       KIRKLAND LAKE                                    27/02/87       5
                             FINAL EFFLUENT                  M10-0077




------------------------------------------------------------------------------------------------
    Field Sample Number...       K-7         K-8         K-9
Test Description
Code,  Units of Measure        M10-0075    M10-0076    M10-0077
------------------ Method   ----------- ----------- ----------- ----------- ----------- -----------

IRON, UNF.TOTAL                  .016        .150        .150
FEUT  ,MG/L as Fe (Iron)
                  522AE2
MANGANESE, UNF.TOTAL             .034        .032        .033
MNUT  ,MG/L as Mn  Manganese
                  522AE2
ALUMINUM, UNF.TOTAL             <.004<      2.000        .780
ALUT  ,MG/L as Al (Aluminum)
                  522AE2
ARSENIC, UNF.TOTAL              <.001<      <.001<      <.001<
ASUT  ,MG/L as As (Arsenic)
                  540AF3
COPPER, UNF.TOTAL.               .002       <.001<W      .010
CUUT  ,MG/L as Cu (Copper)
                  522AE2
LEAD, UNF.TOTAL                 <.003<      <.003<      <.003<
PBUT  ,MG/L as Pb (Lead)
                  522AE2
ZINC, UNF.TOTAL                  .004        .007        .029
ZNUT  ,MG/L as Zn (Zinc)
                  522AE2
```

[illegible] REPORTS Date 25 MAR 1987, Frame 211, Location B 9, Submission PC04525

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[illegible] REPORT Printed 25/03/87

Sample Class: W Results

WATER (GRND/DOMESTIC) WQ Inquiries at: JENIFER McBRIDE
Telephone: 416-235-5875

Field Sample	Sampling Location	Sampling Location Description Sample Description	LAB Sample#	Remarks	Sampling Date	Sampling Time	Zone
K-1	CODE NOT GIVEN	KIRKLAND LAKE RAW WATER - RUN 27	W10-0058		24/02/87		5
K-2	CODE NOT GIVEN	KIRKLAND LAKE CLARIFIER 1.5HRS.H.L.0.4FT CLARIFIER	W10-0059		24/02/87		5
K-3	CODE NOT GIVEN	KIRKLAND LAKE FINAL EFFLUENT	W10-0060		24/02/87		5
K-4	CODE NOT GIVEN	KIRKLAND LAKE RAW WATER - RUN 29	W10-0061		26/02/87		5
K-5	CODE NOT GIVEN	KIRKLAND LAKE CLARIFIER - 2HRS.-0.6FT. H.L.	W10-0062		26/02/87		5
K-6	CODE NOT GIVEN	KIRKLAND LAKE FINAL EFFLUENT	W10-0063		26/02/87		5

Field Sample Number... Test Description Code, Units of Measure Method	K-1 W10-0058	K-2 W10-0059	K-3 W10-0060	K-4 W10-0061	K-5 W10-0062	K-6 W10-0063
CONDUCTIVITY 25C COND25,UMHO/CM at 25 D.CENT. 002BI2	149.0	161.0	160.0	155.0	167.0	164.0
HARDNESS, TOTAL HARDT ,MG/L as CACO3 CALC01	48.0	48.0	48.0	49.0	48.5	49.0
CALCIUM, UNF.REACTIVE CAUR ,MG/L as Ca (Calcium) 002CA1	13.6	13.5	13.7	13.8	13.7	13.8
MAGNESIUM, UNF.REACTIVE MGUR ,MG/L as Mg Magnesium 001CA1	3.40	3.40	3.40	3.50	3.50	3.50
SODIUM, UNF.REACT. NAUR ,MG/L as Na (Sodium) 001EA1	10.6	10.3	9.9	10.2	10.4	10.5
POTASSIUM, UNF.REACT. KKUR ,MG/L as K (Potassium) 002EA1	.50	.45	.45	.50	.45	.45
ALKALINITY,TOTAL ALKT ,MG/L as CACO3 004AT6	40.2	27.2	28.6	41.8	22.3	23.2
PH (-LOG(H+(CONCN))) PH ,DIMENSIONLESS 003AI2	7.66	7.12	7.22	7.74	7.16	7.03
CHLORIDE, UNF.REACTIVE CLIDUR,MG/L as Cl- Chloride	17.70	17.30	17.40	17.20	16.90	17.70

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Sample Class: W Results

WATER (GRND/DOMESTIC) WQ

Inquiries at: JENIFER McBRIDE
Telephone: 416-235-5879

Field Sample Number... Test Description Code, Units of Measure Method	K-1 W10-0058	K-2 W10-0059	K-3 W10-0060	K-4 W10-0061	K-5 W10-0062	K-6 W10-0063
SULPHATE, UNF.REACT. SSO4UR,MG/L as SO4 Sulphate 003A10	8.49	21.18	19.83	8.11	25.56	23.78
TURBIDITY TURB ,FORMAZIN TURB. UNITS 002A11	.30	2.00	.20	.70	1.60	.20
COLOUR, TRUE COLTR ,TRUE COLOUR UNITS 102BC9	15.5	5.5	5.0	15.0	3.5	4.0
PHOSPHORUS, UNF.TOTAL PPUT ,MG/L as P Phosphorus 504BC2	.010<T	<.010<W	<.010<W	<.010<W	<.010<W	<.010<W
NITR'N,TOTAL KJELD,UNF.R NNTKUR,MG/L as N (Nitrogen) 004BC2	.40	.30	.30	.40	.30	.20<T
AMMONIUM,TOTL, FRAC.REAC NNHTFR,MG/L as N (Nitrogen) 103AC2	<.05<W	<.05<W	<.05<W	<.05<W	<.05<W	<.05<W
NITRATES,TOTL, FRAC.REAC NNOTFR,MG/L as N (Nitrogen) 102CC2	<.05<W	<.05<W	<.05<W	<.05<W	<.05<W	.05<T
NITRITE, FRAC.REACT. NNO2FR,MG/L as N (Nitrogen) 102CC2	<.005<W	<.005<W	<.005<W	<.005<W	<.005<W	<.005<W
DISSOLVED ORGANIC CARBON DOC ,MG/L as C (Carbon) 102AC2	6.3	4.1	3.7	6.0	3.1	3.3
LANGELIER'S INDEX LANGI ,DIMENSIONLESS CALC01	-.86	-1.57	-1.45	-.76	-1.62	-1.72

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[illegible], Date 25 MAR 1987, Frame  211, Location D  9, Submission  PC04525

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Sample Class:  W                          Results

WATER (URBAN/DOMESTIC) WQ                     Inquiries at: JENIFER McBRIDE
                                                Telephone: 416-235-5875

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 Field                            Sampling Location Description    LAB                 Sampling
 Sample   Sampling Location       Sample Description               Sample#  Remarks   Date   Time Zone
 -------- ------------------      -------------------------------- -------- -------  -------- ----- ---
     K-7 CODE NOT GIVEN           KIRKLAND LAKE                                      27/02/87        5
                                  RAW WATER - RUN 30               W10-0064
     K-8 CODE NOT GIVEN           CLARIFIER -4.7 HRS.-1.5FT. H.L.                    27/02/87        5
                                  NOT GIVEN                        W10-0065
     K-9 CODE NOT GIVEN           KIRKLAND LAKE                                      27/02/87        5
                                  FINAL EFFLUENT                   W10-0066



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    Field Sample Number...        K-7         K-8         K-9
Test Description
Code,  Units of Measure        W10-0064    W10-0065    W10-0066
----------------- Method      ----------  ----------  ----------  ----------  ----------  ----------

CONDUCTIVITY 25C                 149.0       174.0       171.0
COND25,UMHO/CM at 25 D.CENT.
                    002BI2
HARDNESS, TOTAL                   48.5        48.5        48.0
HARDT ,MG/L as CACO3
                    CALC01
CALCIUM, UNF.REACTIVE             13.7        13.6        13.5
CAUR  ,MG/L as Ca (Calcium)
                    002CA1
MAGNESIUM, UNF.REACTIVE           3.50        3.50        3.40
MGUR  ,MG/L as Mg  Magnesium
                    001CA1
SODIUM, UNF.REACT.                10.2        10.3        10.3
NAUR  ,MG/L as Na (Sodium)
                    001EA1
POTASSIUM, UNF.REACT.              .40         .45         .40
KKUR  ,MG/L as K (Potassium)
                    002EA1
ALKALINITY,TOTAL                  40.3         9.4         8.4
ALKT  ,MG/L as CACO3
                    004AT6
PH (-LOG(H+(CONCN)))              7.59        6.44        6.40
PH    ,DIMENSIONLESS
                    003AI2
CHLORIDE, UNF.REACTIVE           16.90       16.90       16.90
CLIDUR,MG/L as Cl-  Chloride
                    004AC1
```

[illegible] Date 25 MAR 1987, Frame 211, Location E 9, Submission PC04525

onment Ontario PC04525 KIRKLAND LAKE Page 9
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mple Class: W Results

WATER (GRND/DOMESTIC) WQ Inquiries at: JENIFER McBRIDE
Telephone: 416-235-5875

Field Sample Number... Test Description Code, Units of Measure Method	K-7 W10-0064	K-8 W10-0065	K-9 W10-0066
SULPHATE, UNF.REACT. SSO4UR,MG/L as SO4 Sulphate 003AI0	8.37	37.79	37.52
TURBIDITY TURB ,FORMAZIN TURB. UNITS 002AI1	.60	2.40	1.40
COLOUR, TRUE COLTR ,TRUE COLOUR UNITS 102BC9	15.5	2.5<T	2.0<T
PHOSPHORUS, UNF.TOTAL PPUT ,MG/L as P Phosphorus 504BC2	<.010<W	<.010<W	<.010<W
NITR'N,TOTAL KJELD,UNF.R NNTKUR,MG/L as N (Nitrogen) 004BC2	.30	.30	.30
AMMONIUM,TOTL, FRAC.REAC NNHTFR,MG/L as N (Nitrogen) 103AC2	<.05<W	.05<T	.10<T
NITRATES,TOTL, FRAC.REAC NNOTFR,MG/L as N (Nitrogen) 102CC2	.10<T	.15<T	.15<T
NITRITE, FRAC.REACT. NNO2FR,MG/L as N (Nitrogen) 102CC2	<.005<W	<.005<W	.005<T
DISSOLVED ORGANIC CARBON DOC ,MG/L as C (Carbon) 102AC2	6.0	2.3	2.2
LANGELIER'S INDEX LANGI ,DIMENSIONLESS CALC01	-.92	-2.72	-2.81

[illegible] Date 25 MAR 1987, Frame 211, Location F 9, Submission PC04525

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Sample Class: ██ Results

DERIVED RESULTS

Inquiries at: WATER QUALITY OFFICE
Telephone: 416-248-3512

Field Sample	Sampling Location	Sampling Location Description Sample Description	LAB Sample#	Remarks	Sampling Date	Sampling Time	Zone
K-1	CODE NOT GIVEN	KIRKLAND LAKE RAW WATER - RUN 27	ION-CAL		24/02/87		5
K-2	CODE NOT GIVEN	KIRKLAND LAKE CLARIFIER 1.5HRS.H.L.0.4FT CLARIFIER	ION-CAL		24/02/87		5
K-3	CODE NOT GIVEN	KIRKLAND LAKE FINAL EFFLUENT	ION-CAL		24/02/87		5
K-4	CODE NOT GIVEN	KIRKLAND LAKE RAW WATER - RUN 29	ION-CAL		26/02/87		5
K-5	CODE NOT GIVEN	KIRKLAND LAKE CLARIFIER - 2HRS.-0.6FT. H.L.	ION-CAL		26/02/87		5
K-6	CODE NOT GIVEN	KIRKLAND LAKE FINAL EFFLUENT	ION-CAL		26/02/87		5

Field Sample Number... Test Description Code, Units of Measure Method	K-1 ION-CAL	K-2 ION-CAL	K-3 ION-CAL	K-4 ION-CAL	K-5 ION-CAL	K-6 ION-CAL
ION BALANCE CALCULATION CONDTY,UMHO/CM AT 25C	162.6	170.3	169.2	162.4	173.5	173.9
ION BALANCE CALCULATION DISOL ,MG/L	78.80	82.71	82.12	78.80	84.11	84.10
ION BALANCE CALCULATION IONBL ,%	3.313	4.215	4.960	3.957	1.325	1.155

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  [illegible]   Date 25 MAR 1987, Frame  211, Location G  9, Submission  PC04525

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Sample Class: ##                            Results

DERIVED RESULTS                                Inquiries at: WATER QUALITY OFFICE
                                                 Telephone: 416-248-3512

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Field                                 Sampling Location Description   LAB                      Sampling
Sample  Sampling Location             Sample Description              Sample#   Remarks    Date     Time Zone
-------- -------------------------    ------------------------------  --------- -------   --------  ----- ---

     K-7 CODE NOT GIVEN               KIRKLAND LAKE                                       27/02/87         5
                                      RAW WATER - RUN 30              ION-CAL
     K-8 CODE NOT GIVEN               CLARIFIER -4.7 HRS.-1.5FT. H.L.                     27/02/87         5
                                      NOT GIVEN                       ION-CAL
     K-9 CODE NOT GIVEN               KIRKLAND LAKE                                       27/02/87         5
                                      FINAL EFFLUENT                  ION-CAL




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    Field Sample Number...         K-7         K-8         K-9
Test Description
Code,  Units of Measure          ION-CAL     ION-CAL     ION-CAL
------------------ Method      ----------- ----------- ----------- ----------- ----------- -----------

ION BALANCE CALCULATION         161.0       182.6       180.8
CONDTY,UMHO/CM AT 25C

ION BALANCE CALCULATION         78.09       89.00       87.93
DISOL ,MG/L

ION BALANCE CALCULATION         2.680       2.235       1.216
IONBL ,%
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[illegible] REPORTS - Date 25 MAR 1987, Frame  211, Location H  9, Submission  PC04525

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     --------------------------------------------------------------------------------
                              --------------------------
                        <    ACTUAL RESULT IS LESS THAN THE REPORTED VALUE
                        <T   THIS LOW MEASUREMENT IS TENTATIVE. FOR INFO ONLY
                        <W   "ZERO". VALUE REPORTED IS MIN. MEASURABLE AMOUNT
*** END OF REPORT ***
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[illegible]     Date  8 APR 1987, Frame  250, Location G 13, Submission  PC04526

      [illegible] Ontario                                                           Page   1
      REPORT                                                             Printed  08/04/87
Municipality/Project:   K I R K L A N D   L A K E                 Submission:   P C 0 4 5 2 6


Sampling Date(s):            M A R  0 3, 1 9 8 7


 Program.....  0700801                   WATER TREATMENT RESEARCH  TECHNICAL ADVISORY
 Agency......  01030106

Sampled by:    BOBB, A.               Date Submitted:  05/03/87,    Date Received:  05/03/87


 ..........  Mail this copy to  .........  Martin, G
                                           WRB:DRINKING WATER
                                           P.O.BOX 213,125 RESOURCES ROAD
                                           REXDALE,ONTARIO
                                           M9W 5L1


 Final reports to  Martin, G               WRB:DRINKING WATER     Telephone: 416-235-5829

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 Field                                                                        Sampling
 Sample   Sampling Location     Sampling Location Description              Date    Time   Zone
 -------- --------------------  ---------------------------------------   -------- -----  --
      K1  CODE NOT GIVEN        KIRKLAND LAKE                              03/03/87        5

          Sample Description                      Lab Sample#  Remarks  Lab Sample#  Remarks
          -------------------------------------   -----------  -------  -----------  -------
          RAW WATER - RUN - 33                     W10-0246              W10-0232

          TESTS REQUESTED:  G+REMT01                G+REMT05
                            +LANGI

---------------------------------------------------------------------------------------------
 Field                                                                        Sampling
 Sample   Sampling Location     Sampling Location Description              Date    Time   Zone
 -------- --------------------  ---------------------------------------   -------- -----  --
      K2  CODE NOT GIVEN        KIRKLAND LAKE                              03/03/87        5

          Sample Description                      Lab Sample#  Remarks  Lab Sample#  Remarks
          -------------------------------------   -----------  -------  -----------  -------
          CLARIFIER-3HRS. H.L.O.4FT.               W10-0247              W10-0233

          TESTS REQUESTED:  G+REMT01                G+REMT05
                            +LANGI

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[illegible]  Date  8 APR 1987, Frame  250, Location H 13, Submission  PC04526

onment Ontario              PC04526        KIRKLAND LAKE                                  Page   2
[illegible]    REPORT                                                             Printed  08/04/87

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Field                                                                         Sampling
Sample   Sampling Location      Sampling Location Description                 Date     Time   Zone
-----    -------------------    ----------------------------------------      --------  -----  --
   K3    CODE NOT GIVEN         KIRKLAND LAKE                                 03/03/87         5

         Sample Description                           Lab Sample#  Remarks   Lab Sample#  Remarks
         ----------------------------------------     -----------  --------  -----------  --------
         FINAL EFF.-3HRS.-H.L.O.4FT.                   H10-0248               H10-0234

         TESTS REQUESTED:  G+RENT01                 G+RENT05
                           +LANGI

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[illegible] ate 8 APR 1987, Frame 250, Location I 13, Submission PC04526

[illegible] Ontario PC04526 KIRKLAND LAKE Page 3
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[illegible] Class. M Results

Metals in Water IIC Inquiries at: Prem Vijan / Pat Lachmaniuk 235-6004
Telephone: 416-235-5834

Field Sample	Sampling Location	Sampling Location Description Sample Description	LAB Sample#	Remarks	Sampling Date	Sampling Time	Zone
K1	CODE NOT GIVEN	KIRKLAND LAKE RAW WATER - RUN - 33	M10-0232		03/03/87		5
K2	CODE NOT GIVEN	KIRKLAND LAKE CLARIFIER-3HRS. H.L.O.4FT.	M10-0233		03/03/87		5
K3	CODE NOT GIVEN	KIRKLAND LAKE FINAL EFF.-3HRS.-H.L.O.4FT.	M10-0234		03/03/87		5

Field Sample Number ... Test Description Code, Units of Measure Method	K1 M10-0232	K2 M10-0233	K3 M10-0234
IRON, UNF.TOTAL FEUT ,MG/L as Fe (Iron) 622AE2	.100	.120	.100
MANGANESE, UNF.TOTAL MNUT ,MG/L as Mn Manganese 622AE2	.093	.035	.034
ALUMINUM, UNF.TOTAL ALUT ,MG/L as Al (Aluminum) 622AE2	.019	1.200	.140
ARSENIC, UNF.TOTAL ASUT ,MG/L as As (Arsenic) 640AF3	<.001<	<.001<	<.001<
COPPER, UNF.TOTAL. CUUT ,MG/L as Cu (Copper) 622AE2	.005	.001	.006
LEAD, UNF.TOTAL PBUT ,MG/L as Pb (Lead) 622AE2	<.003<	<.003<	.011
ZINC, UNF.TOTAL ZNUT ,MG/L as Zn (Zinc) 622AE2	.003	.008	.050

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     Date  8 APR 1987, Frame  250, Location J 13, Submission  PC04526

   ment Ontario              PC04526        KIRKLAND LAKE                                  Page   4
       REPORT                                                                    Printed  08/04/87

ample Class:  M                                 Results

WATER (GRND/DOMESTIC) WQ                    Inquiries at: JENIFER McBRIDE
                                               Telephone: 416-235-5875

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Field                              Sampling Location Description    LAB                  Sampling
Sample   Sampling Location         Sample Description               Sample#  Remarks  Date     Time  Zone
-------- ------------------------- -------------------------------- -------- -------- -------- ----- ---
     K1 CODE NOT GIVEN             KIRKLAND LAKE                                      03/03/87        5
                                   RAW WATER - RUN - 33             W10-0246
     K2 CODE NOT GIVEN             KIRKLAND LAKE                                      03/03/87        5
                                   CLARIFIER-3HRS. H.L.O.4FT.       W10-0247
     K3 CODE NOT GIVEN             KIRKLAND LAKE                                      03/03/87        5
                                   FINAL EFF.-3HRS.-H.L.O.4FT.      W10-0248


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   Field Sample Number...          K1          K2          K3
Test Description
Code,  Units of Measure        W10-0246    W10-0247    W10-0248
------------------- Method    ----------- ----------- ----------- ----------- ----------- -----------

CONDUCTIVITY 25C                 153.0       165.0       166.0
COND25,UMHO/CM at 25 D.CENT.
                   002BI2
HARDNESS, TOTAL                   48.5        49.0        49.5
HARDT ,MG/L as CACO3
                   CALC01
CALCIUM, UNF.REACTIVE             13.7        13.7        14.0
CAUR  ,MG/L as Ca (Calcium)
                   002CA1
MAGNESIUM, UNF.REACTIVE           3.50        3.60        3.50
MGUR  ,MG/L as Mg  Magnesium
                   001CA1
SODIUM, UNF.REACT.                10.6        10.9        10.8
NAUR  ,MG/L as Na (Sodium)
                   001EA1
POTASSIUM, UNF.REACT.              .45         .45         .40
KKUR  ,MG/L as K (Potassium)
                   002EA1
ALKALINITY,TOTAL                  40.8        18.4        19.0
ALKT  ,MG/L as CACO3
                   004AT6
PH (-LOG(H+(CONCN)))              7.55        6.68        6.67
PH    ,DIMENSIONLESS
                   003AI2
CHLORIDE, UNF.REACTIVE           17.40       17.30       17.40
CLIDUR,MG/L as Cl-  Chloride
                   004AC1
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Date 8 APR 1987, Frame 250, Location K 13, Submission PC04526

Environment Ontario
REPORT

PC04526 KIRKLAND LAKE

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Sample Class: W

Results

WATER (GRND/DOMESTIC) WG

Inquiries at: JENIFER McBRIDE
Telephone: 416-235-5875

Field Sample Number ... Test Description Code, Units of Measure Method	K1 W10-0246	K2 W10-0247	K3 W10-0248
SULPHATE, UNF.REACT. SSO4UR,MG/L as SO4 Sulphate 003A10	9.5	30.77	30.13
TURBIDITY TURB ,FORMAZIN TURB. UNITS 002A11	.40	1.80	1.10
COLOUR, TRUE COLTR ,TRUE COLOUR UNITS 102BC9	16.5	4.0	3.5
PHOSPHORUS, UNF.TOTAL PPUT ,MG/L as P Phosphorus 504BC2	.020<T	<.010<W	<.010<W
NITR'N,TOTAL KJELD,UNF.R NNTKUR,MG/L as N (Nitrogen) 004BC2	.10<T	<.05<W	<.05<W
AMMONIUM,TOTL, FRAC.REAC NNHTFR,MG/L as N (Nitrogen) 103AC2	<.05<W	<.05<W	<.05<W
NITRATES,TOTL, FRAC.REAC NNOTFR,MG/L as N (Nitrogen) 102CC2	<.05<W	<.05<W	<.05<W
NITRITE, FRAC.REACT. NNO2FR,MG/L as N (Nitrogen) 102CC2	<.005<W	<.005<W	<.005<W
DISSOLVED ORGANIC CARBON DOC ,MG/L as C (Carbon) 102AC2	6.3	2.6	2.8
LANGELIER'S INDEX LANGI ,DIMENSIONLESS CALC01	-.96	-2.18	-2.17

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ate  C APR 1987, Frame  250, Location L 13, Submission  PC04526

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  lass: WW                           Results

 RESULTS                                 Inquiries at: WATER QUALITY OFFICE
                                            Telephone: 416-248-3512

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Field                             Sampling Location Description   LAB                  Sampling
Sample   Sampling Location        Sample Description              Sample#   Remarks   Date    Time Zone
-------- ------------------       ------------------------------  --------- -------   -------- ----- ---

      K1 CODE NOT GIVEN           KIRKLAND LAKE                                       03/03/87        5
                                  RAW WATER - RUN - 33            ION-CAL
      K2 CODE NOT GIVEN           KIRKLAND LAKE                                       03/03/87        5
                                  CLARIFIER-3HRS. H.L.O.4FT.      ION-CAL
      K3 CODE NOT GIVEN           KIRKLAND LAKE                                       03/03/87        5
                                  FINAL EFF.-3HRS.-H.L.O.4FT.     ION-CAL



---------------------------------------------------------------------------------------

   Field Sample Number ...           K1         K2          K3
Test Description
Code,  Units of Measure          ION-CAL    ION-CAL     ION-CAL
------------------- Method     ---------- ----------- ----------- ----------- ----------- -----------

ION BALANCE CALCULATION                     180.9       180.7
CONDTY,UMHO/CM AT 25C

ION BALANCE CALCULATION                     87.94       87.01
DIGOL ,MG/L

ION BALANCE CALCULATION              NAF    2.091       2.114
IONBL ,%
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                 <   ACTUAL RESULT IS LESS THAN THE REPORTED VALUE
                 <T  THIS LOW MEASUREMENT IS TENTATIVE. FOR INFO ONLY
                 <M  "ZERO". VALUE REPORTED IS MIN. MEASURABLE AMOUNT
                 NAF NOT ALL REQUIRED TESTS FOUND

*** END OF REPORT ***
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                Date 4 Mar 1987, Frame  307, Location I 16. Submission  PC04528

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Municipality/Project:  K I R K L A N D   L A K E                  Submission:   P C 0 4 5 2 8


Sampling Date(s):            M A R  1 5, 1 9 8 7  to  M A R  2 5, 1 9 8 7


  Program.....  0700001                     WATER TREATMENT RESEARCH  TECHNICAL ADVISORY
  Agency......  01030106

Sampled by:                            Date Submitted:  27/03/87,    Date Received:  27/03/87


 ..........  Mail this copy to  ......... Martin, G
                                         WRB:DRINKING WATER
                                         P.O.BOX 213,125 RESOURCES ROAD
                                         REXDALE,ONTARIO
                                         M9W 5L1


  Final reports to  Martin, G            WRB:DRINKING WATER    Telephone: 416-235-5829

---Field-----------------------------------------------------------------Sampling---------------
  Sample  Sampling Location     Sampling Location Description            Date     Time   Zone
  ------  ------------------    ---------------------------------       --------  -----   --
     K-1  CODE NOT GIVEN        KIRKLAND LAKE                           25/03/87          5

          Sample Description                       Lab Sample#  Remarks  Lab Sample#  Remarks
          -------------------------------------    -----------  -------  -----------  -------
          RAW INFLUENT RUN-45                        M13-0161              M13-0294

          TESTS REQUESTED:  G+RENT01                 G+RENT05
                             +LANGI

---Field-----------------------------------------------------------------Sampling---------------
  Sample  Sampling Location     Sampling Location Description            Date     Time   Zone
  ------  ------------------    ---------------------------------       --------  -----   --
     K-2  CODE NOT GIVEN        KIRKLAND LAKE                           25/03/87          5

          Sample Description                       Lab Sample#  Remarks  Lab Sample#  Remarks
          -------------------------------------    -----------  -------  -----------  -------
          CLARIFIER 7HRS HL 2.1 FT                   M13-0162              M13-0295

          TESTS REQUESTED:  G+RENT01                 G+RENT05
                             +LANGI

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         ---------------------------------------------------------------------------
Field                                                                  Sampling
Sample   Sampling Location      Sampling Location Description       Date     Time  Zone
         --------------------   --------------------------------   -------- -----  --
   K-3   CODE NOT GIVEN         KIRKLAND LAKE                      25/03/87         5

         Sample Description                  Lab Sample#  Remarks  Lab Sample#  Remarks
         ----------------------------------  -----------  -------  -----------  -------
         FINAL EFF. 7HRS.HL 2.1 FT            N13-0296              N13-0163

         TESTS REQUESTED:  G+RENT01          G+RENT05
                           +LANG1

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Field                                                                  Sampling
Sample   Sampling Location      Sampling Location Description       Date     Time  Zone
-------  --------------------   --------------------------------   -------- -----  --
   K-4   CODE NOT GIVEN         KIRKLAND LAKE                      15/03/87         5

         Sample Description                  Lab Sample#  Remarks  Lab Sample#  Remarks
         ----------------------------------  -----------  -------  -----------  -------
         RAW INFLUENT RUN #37                 N13-0164              N13-0297

         TESTS REQUESTED:  G+RENT01          G+RENT05
                           +LANG1

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Field                                                                  Sampling
Sample   Sampling Location      Sampling Location Description       Date     Time  Zone
-------  --------------------   --------------------------------   -------- -----  --
   K-5   CODE NOT GIVEN         KIRKLAND LAKE                      15/03/87         5

         Sample Description                  Lab Sample#  Remarks  Lab Sample#  Remarks
         ----------------------------------  -----------  -------  -----------  -------
         CLARIFIER 6HRS HL 1.6FT              N13-0165              N13-0298

         TESTS REQUESTED:  G+RENT01          G+RENT05
                           +LANG1

---------------------------------------------------------------------------------------
Field                                                                  Sampling
Sample   Sampling Location      Sampling Location Description       Date     Time  Zone
-------  --------------------   --------------------------------   -------- -----  --
   K-6   CODE NOT GIVEN         KIRKLAND LAKE                      26/03/87         5

         Sample Description                  Lab Sample#  Remarks  Lab Sample#  Remarks
         ----------------------------------  -----------  -------  -----------  -------
         FINAL EFFLUENT 6HRS HL 1.6 FT        N13-0166              N13-0299

         TESTS REQUESTED:  G+RENT01          G+RENT05
                           +LANG1

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Date 4 MAY 1987, Frame 337, Location K 16. Submission PC04528

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Sample Class: W Results

Metals in Water ITC Inquiries at: Prem Vijan / Pat Lachmaniuk 235-6004
Telephone: 416-235-5834

Field Sample	Sampling Location	Sampling Location Description Sample Description	LAB Sample#	Remarks	Sampling Date	Time	Zone
K-1	CODE NOT GIVEN	KIRKLAND LAKE RAW INFLUENT RUN-45	M13-0294		25/03/87		5
K-2	CODE NOT GIVEN	KIRKLAND LAKE CLARIFIER 7HRS HL 2.1 FT	M13-0295		25/03/87		5
K-3	CODE NOT G'VEN	KIRKLAND LAKE FINAL EFF. 7HRS.HL 2.1 FT	M13-0296		25/03/87		5
K-4	CODE NOT GIVEN	KIRKLAND LAKE RAW INFLUENT RUN 837	M13-0297		15/03/87		5
K-5	CODE NOT GIVEN	KIRKLAND LAKE CLARIFIER 6HRS HL 1.6FT	M13-0298		15/03/87		5
K-6	CODE NOT GIVEN	KIRKLAND LAKE FINAL EFFLUENT 6HRS HL 1.6 FT	M13-0299		25/03/87		5

Field Sample Number ... Test Description Code, Units of Measure Method	K-1 M13-0294	K-2 M13-0295	K-3 M13-0296	K-4 M13-0297	K-5 M13-0298	K-6 M13-0299
IRON, UNF.TOTAL FEUT ,MG/L as Fe (Iron) E22AE2	.060	.081	.054	.002	.310	.110
MANGANESE, UNF.TOTAL MNUT ,MG/L as Mn Manganese E22AE2	.053	.046	.040	.110	.040	.038
ALUMINUM, UNF.TOTAL ALUT ,MG/L as Al (Aluminum) E22AE2	.270	1.400	.098	.029	1.300	.056
ARSENIC, UNF.TOTAL ASUT ,MG/L as As (Arsenic) E40AF3	<.001<	<.001<	<.001<	<.001<	<.001<	<.001<
COPPER, UNF.TOTAL. CUUT ,MG/L as Cu (Copper) E22AE2	.005	.002	.013	.009	.002	.015
LEAD, UNF.TOTAL PBUT ,MG/L as Pb (Lead) E22AE2	<.003<	<.003<	.600	.007	.004	.150
ZINC, UNF.TOTAL ZNUT ,MG/L as Zn (Zinc) E22AE2	.002	.003	.020	.001	.004	.032

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[illegible]ronment Ontario PC04528 KIRKLAND LAKE Page 4
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[illegible] Class: N

Results

WATER (LAND/DOMESTIC) MO

Inquiries at: JENIFER McBRIDE
Telephone: 416-235-5075

Field Sample	Sampling Location	Sampling Location Description Sample Description	LAB Sample#	Remarks	Sampling Date	Time	Zone
K-1	CODE NOT GIVEN	KIRKLAND LAKE RAW INFLUENT RUN-45	M13-0161		25/03/87		5
K-2	CODE NOT GIVEN	KIRKLAND LAKE CLARIFIER 7HRS HL 2.1 FT	M13-0162		25/03/87		5
K-3	CODE NOT GIVEN	KIRKLAND LAKE FINAL EFF. 7HRS.HL 2.1 FT	M13-0163		25/03/87		5
K-4	CODE NOT GIVEN	KIRKLAND LAKE RAW INFLUENT RUN #37	M13-0164		15/03/87		5
K-5	CODE NOT GIVEN	KIRKLAND LAKE CLARIFIER 6HRS HL 1.6FT	M13-0165		15/03/87		5
K-6	CODE NOT GIVEN	KIRKLAND LAKE FINAL EFFLUENT 6HRS HL 1.6 FT	M13-0166		25/03/87		5

Field Sample Number... Test Description Code, Units of Measure Method	K-1 M13-0161	K-2 M13-0162	K-3 M13-0163	K-4 M13-0164	K-5 M13-0165	K-6 M13-0166
CONDUCTIVITY 25C COND25,UMHO/CM at 25 D.CENT. 002B12	157.0	172.0	173.0	151.0	167.0	166.0
HARDNESS, TOTAL HARDT ,MG/L as CACO3 CALC01	54.0	51.5	53.0	50.0	49.0	50.0
CALCIUM, UNF.REACTIVE CAUR ,MG/L as Ca (Calcium) 002CA1	15.4	14.6	15.1	14.2	14.0	14.1
MAGNESIUM, UNF.REACTIVE MGUR ,MG/L as Mg Magnesium 001CA1	3.80	3.60	3.70	3.50	3.50	3.60
SODIUM, UNF.REACT. NAUR ,MG/L as Na (Sodium) 001EA1	10.2	10.5	10.8	10.1	10.5	10.0
POTASSIUM, UNF.REACT. KKUR ,MG/L as K (Potassium) 002EA1	.45	.45	.45	.45	.45	.45
ALKALINITY,TOTAL ALKT ,MG/L as CACO3 004AT6	41.2	25.2	23.4	40.8	23.8	21.2
PH (-LOG(H+(CONCN))) PH ,DIMENSIONLESS 003A12	7.62	7.00	6.95	7.57	6.97	7.16
CHLORIDE, UNF.REACTIVE CLIDUR,MG/L as Cl- Chloride 004AC1	16.90	16.80	16.70	16.70	16.10	16.70

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[illegible] Class: W Results

WATER (GRND/DOMESTIC) WQ Inquiries at: JENIFER McBRIDE
Telephone: 416-235-5875

Field Sample Number... Test Description Code, Units of Measure Method	K-1 M13-0161	K-2 M13-0162	K-3 M13-0163	K-4 M13-0164	K-5 M13-0165	K-6 M13-0166
SULPHATE. UNF.REACT. SSO4UR,MG/L as SO4 Sulphate 003A10	6.90	28.20	27.50	5.00	28.70	29.70
TURBIDITY TURB ,FORMAZIN TURB. UNITS 002A11	.85	1.53	.23	.82	1.42	.37
COLOUR, TRUE COLTR ,TRUE COLOUR UNITS 102DC9	16.5	4.0	4.0	16.0	4.5	5.5
PHOSPHORUS, UNF.TOTAL PPUT ,MG/L as P Phosphorus 504DC2	.010<T	.020<T	.020<T	.020<T	.020<T	.010<T
NITR'N,TOTAL KJELD,UNF.R NNTKUR,MG/L as N (Nitrogen) 004DC2	.30	.50	.40	.20<T	.20<T	.20<T
AMMONIUM,TOTL, FRAC.REAC NNHTFR,MG/L as N (Nitrogen) 103AC2	<.05<W	.15<T	.15<T	<.05<W	.10<T	.10<T
NITRATES,TOTL, FRAC.REAC NNOTFR,MG/L as N (Nitrogen) 102CC2	<.05<W	<.05<W	.10<T	<.05<W	<.05<W	.05<T
NITRITE, FRAC.REACT. NNO2FR,MG/L as N (Nitrogen) 102CC2	<.005<W	<.005<W	<.005<W	<.005<W	<.005<W	<.005<W
DISSOLVED ORGANIC CARBON DOC ,MG/L as C (Carbon) 102AC2	6.5	3.3	3.3	7.0	3.3	3.0
LANGELIER'S INDEX LANGI ,DIMENSIONLESS CALC01	-.80	-1.10	-1.00	-.90	-1.00	-1.60

ironment Ontario PC04528 KIRKLAND LAKE Page 6
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ample Class: 08 Results

RIVED RESULTS

Inquiries at: WATER QUALITY OFFICE
Telephone: 416-248-3512

Field Sample	Sampling Location	Sampling Location Description Sample Description	LAB Sample#	Remarks	Sampling Date	Time	Zone
K-1	CODE NOT GIVEN	KIRKLAND LAKE RAW INFLUENT RUN-45	ION-CAL		25/03/87		5
K-2	CODE NOT GIVEN	KIRKLAND LAKE CLARIFIER 7HRS ML 2.1 FT	ION-CAL		25/03/87		5
K-3	CODE NOT GIVEN	KIRKLAND LAKE FINAL EFF. 7HRS.ML 2.1 FT	ION-CAL		25/03/87		5
K-4	CODE NOT GIVEN	KIRKLAND LAKE RAW INFLUENT RUN #37	ION-CAL		15/03/87		5
K-5	CODE NOT GIVEN	KIRKLAND LAKE CLARIFIER 6HRS ML 1.6FT	ION-CAL		15/03/87		5
K-6	CODE NOT GIVEN	KIRKLAND LAKE FINAL EFFLUENT 6HRS ML 1.6 FT	ION-CAL		25/03/87		5

Field Sample Number ... Test Description Code, Units of Measure Method	K-1 ION-CAL	K-2 ION-CAL	K-3 ION-CAL	K-4 ION-CAL	K-5 ION-CAL	K-6 ION-CAL
ION BALANCE CALCULATION CONDTY,UMHO/CM AT 25C	165.0	104.0	104.1	156.2	179.8	180.3
ION BALANCE CALCULATION DISOL ,MG/L	78.77	89.71	89.15	74.03	87.09	87.03
ION BALANCE CALCULATION IONBL ,%	6.394	4.046	2.003	4.073	4.464	4.361

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[illegible]          PC04528      KIRKLAND LAKE                    Page    7
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        ----------------------------------------------------------------------
                   -------------------------
              <   ACTUAL RESULT IS LESS THAN THE REPOR..D VALUE
              <T  THIS LOW MEASUREMENT IS TENTATIVE. FOR INFO ONLY
              <W  "ZERO". VALUE REPORTED IS MIN. MEASURABLE AMOUNT

*** END OF REPORT ***
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